**PRESENTED AT THE UNCONVENTIONAL THERAPIES CONFERENCE,
MONTE-CARLO, MONACO, 6 & 7 DECEMBER 1996**

ENDOGENOUS ELECTROMAGNETIC FIELD PATTERN FORMATION IN WATER

O. Zhalko-Tytarenko, V.Liventsov, G.Lednyiczky

Hippocampus Research Facilities,
H-1092 Budapest, Ráday utca 8., Hungary
Tel: (+361) 299-0200; Fax(+361) 299-0201
e-mail: office@hippocampus-brt.com
web site:www.hippocampus-brt.com

Introduction

By studying the therapy for electrically sensitive patients (in whom the allergic reactions may be compensated or even neutralized by exposure to certain frequencies of an electromagnetic oscillator) C. Smith and J. Monro found [1] that exactly the same response can be achieved when a patient holds a vial with mineral water or saline solution previously exposed to the same frequency. Water (at least that in the proximity of a human) seems to be able to "remember", for at least six weeks, the frequencies of magnetic fields to which it has been exposed.
The authors of [2] have provided the evidence that the UV spectrum of water (in the region of 190-220 nm) can be changed with extremely weak influences (high dilution homeopathic remedies or extremely low frequency endogenous electromagnetic fields transduced with the BICOM device). In this work, BICOM-induced changes in UV absorption of water are reproduced within at least an hour.

The following considerations make it possible to expect observable changes in the free energy of hydrogen bond formation in water under the influence of extremely low frequency extremely

low intensity endogenous electromagnetic field of a biological solution. The actual occurrence of such changes in turn will support the model of hierarchical dynamic organization of supramolecular water structures and interlevel communication through hydrogen-bond interactions within this dynamic hierarchy.

1) Biomolecules' evolution in an aqueous medium results in the necessity of structural and, under physiological conditions, dynamic conformity of the protein's secondary structure and H-bonded water clusters in the vicinity of a protein molecule;

2) Water/protein system is strongly coupled via inter- and intramolecular hydrogen bonds. In such a system, even very small defects (e.g. created by extremely low electromagnetic bioresonance field) can be transferred over great distances approximately immediately.

3) Water has a high dielectric constant and thus will readily absorb electromagnetic waves (including the extremely low endogenous electromagnetic fields of biological systems, of course) between the species, i.e. in a case when water did not partake in bioresonance interactions, it would completely absorb extremely weak bioelectromagnetic fields.

The dynamics of liquid water comprises many small molecular movements of an hierarchical kind within large basins and jumps from one basin to another [3 and references therein]. The average lifetime of an individual hydrogen bond in liquid water is known to be 2-3 ps whereas that of a global hydrogen-bond network structure is about 30 ps [4]. These lifetimes account for more "strong" hydrogen-bond interactions inside water clusters, which is evidenced by the structure of the band in the IR spectra of water [5]. One should distinguish these "core" interactions from the more "weak" hydrogen-bond interactions at the surface of water clusters. The occurrence of the hyperbolic region in the power spectrum of total system (64 water molecules) potential energy in the instantaneous structures of liquid water indicates that the correlation of hydrogen-bond network fluctuations decays through multiple processes [3]. Longer timescale dynamics involves still more coupled events.

In fact, any biochemical process shows cooperative behavior which is determined by noncovalent interactions [6, 7 and references therein].

Proton polarizability of the structurally symmetrical

$$B\text{-}H\ldots B = B\ldots H\text{-}B$$

bond within $H_5O_2^+$ group is shown to be about two orders of magnitude larger than the usual polarizabilities caused by the distortion of electron systems [8].

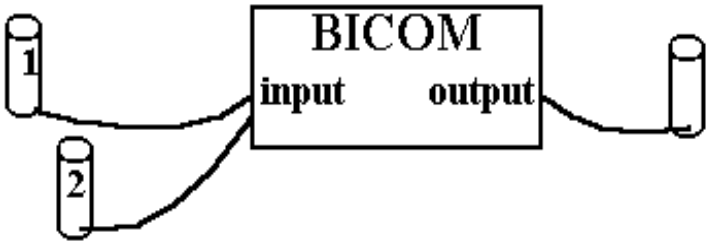
This phenomenon is due to the proton migration within hydrogen bonds and results in at least three interaction effects: an interaction between such hydrogen bonds via proton dispersion

forces; an induced dipole interaction of the hydrogen bonds with the fields from their environment; and interaction between the transitions in the hydrogen bond and other vibrations [9].

According to *ab initio* SCF calculations, H-bonded chains with multiminima proton potentials show still larger proton polarizabilities than single H-bonds with double minima potential [10]. Since the first excited level of a tunneling proton is separated only slightly from the ground level, an extremely small electrical field is sufficient for the first excited state to be mixed with the ground state.

Materials and Methods

The endogenous electromagnetic field (EEMF) of human blood serum preparations is modified and transduced by the BICOM device (Brügemann, Germany) . In all cases, a 10 Hz - 150 kHz bandpass of the EEMF is used. Treatment mode "A" corresponds to the transduction of all oscillations without phase modification, whereas "Ai" stands for phase inversion of all acquired oscillations in the above band. Treatment mode "H" corresponds to the filtering out of the oscillations according to their shape with the following transduction of only "physiological" oscillations which are supposed to be harmonious.



Input 1 - The blood serum of a healthy donor

Input 2 - The blood serum of a cancer patient

Output - distilled water

Preparations of the blood serum of four patients with breast cancer or four healthy donors' serum albumin preparations are used as a source of the endogenous ELM at the "input" of the device. Distilled water treated with Millipore M740 system (Waters, USA) is used at the "output". Water is treated during various periods of time with the BICOM modulations summarized in Table 1.

The free energy of the transition from free OH groups in water to H-bonded (ΔG) can be experimentally estimated by using the temperature dependence of the equilibrium constant:

$$(OH)_{free} = (OH)_{bond}$$
$$K_{eqv.} = [(OH)_{bond}]/[(OH)_{free}]$$
$$\Delta G = -RT\ln K_{eqv.}$$

([$(OH)_{free}$] and [$(OH)_{bond}$] are the equilibrium concentrations of free and H-bonded OH groups correspondingly; R - gas constant, T - temperature). Equilibrium concentrations of free and H-bonded OH groups are estimated from the difference spectra in the near IR region (1450 nm band which corresponds to $\nu_1+\nu_3$ vibration of the water molecule) [11]. Free energy of H-bond formation is calculated from the plots of ln(A1.49/A1.41) against 1/T.

IR spectra in the near infrared region (1.38-1.70 mm) are measured by using the "Compscan 7000" spectrometer (Pacific Scientific, USA) in CaF_2 or teflon cuvettes (2 nm resolution). The spectra are acquired over a 20 sec period with a speed of 2 scans per sec.

Table 1. Free energy of H-bond formation in water after bioresonance treatment*.

BICOM modulation		**Exposure time, min**						
Mode	**Amplif.**	**2**	**4**	**6**	**8**	**10**	**15**	**20**
		ΔG, kcal/mol (± 4%)						
A	50	1.53 1.99	1.98 2.07	2.02 2.10	2.58 1.98	1.82 1.98	1.64 1.98	1.57 bc 1.98 sa
Ai	50	2.41 2.11	1.60 2.09	2.56 2.07	1.68 2.12	1.71 2.12	1.55 2.12	1.42 bc 2.13 sa
A	0.05	1.33 2.15	2.51 1.98	2.08 2.12	2.22 2.15	1.85 2.10	1.87 2.10	1.51 sa 2.11 bc
Ai	0.05	1.71 2.12	1.55 2.10	1.87 2.10	2.20 2.17	2.52 2.13	2.50 2.12	2.57 bc 2.12 sa
H	0.1	2.71 1.99	2.66 1.99	2.65 2.11	2.58 2.07	2.51 1.97	2.49 1.99	2.50 bc 1.98 sa
H	0.5	1.98 2.23	2.11 2.22	2.10 2.16	1.93 2.12	2.13 2.14	1.93 2.14	1.78 bc 2.16 sa
H	1.0	1.97 2.13	2.08 2.13	2.31 2.14	1.99 2.14	2.09 2.14	2.15 2.13	1.98 bc 2.14 sa
H	2.0	1.77 1.90	1.66 2.02	1.36 1.97	1.28 1.97	1.07 1.97	1.12 1.98	1.04 bc 1.98 sa
H	3.0	1.87 1.90	2.01 1.88	1.98 1.92	1.80 1.93	1.82 1.90	1.81 1.87	1.76 bc 1.90 sa
H	4.5	2.11 2.01	1.78 2.05	2.17 2.09	1.98 2.13	1.95 2.08	1.99 2.03	1.90 bc 2.07 sa

* - raw data marked with “bc” correspond to the results for the endogenous electromagnetic field of breast cancer patients’ blood serum and those marked with “sa” - healthy donors’ blood serum preparations

The $DG_{H\text{-}bond}$ in a water sample before treatment with the BICOM device is estimated by the same procedure and is equal to 2.75 ± 0.08 kcal/mol.

Table 1 shows the decrease in the free energy of hydrogen bond formation in water treated with the EEMF of both “physiological” and “pathological” blood serum preparation. However, $\Delta G_{H\text{-}bond}$ in water samples treated with the EMF of breast cancer patients’ blood serum show more pronounced dependences on the duration of treatment. This can be more clearly viewed in the Poincaré maps $(\Delta G_{H\text{-}bond})_{n+1} \rightarrow (\Delta G_{H\text{-}bond})_n$ for both sets of EMF-treated water samples (Fig. 1-10).

The observed difference in the degree of the dynamic response of the hydrogen bond network in water samples treated with the endogenous electromagnetic field of healthy donors’ blood serum preparations (“physiological “ blood serum EEMF) and breast cancer patients’ blood serum preparations (“pathological” blood serum EEMF) may be due to the occurrence of extremely large supramolecular structures in water and biological solutions (e.g., blood serum), which are probably inherited from the evolution of biomacromolecules in aqueous medium. The “physiological” case corresponds to more complementarity in the configuration of water clusters and protein molecules than “pathological”. Therefore, the EEMF of the “physiological” blood serum better fits the dynamics of hydrogen bonding network within supramolecular structures in water.

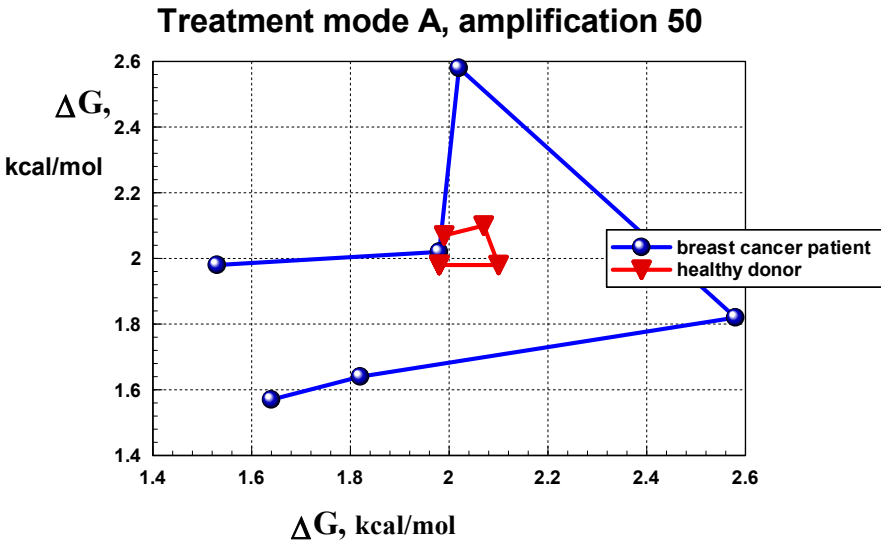

Treatment mode A, amplification 50
ΔG, kcal/mol
2.6
2.4
2.2
2
1.8
1.6
1.4
1.4
1.6
1.8
2
2.2
2.4
2.6
ΔG, kcal/mol
breast cancer patient
healthy donor

Fig. 1

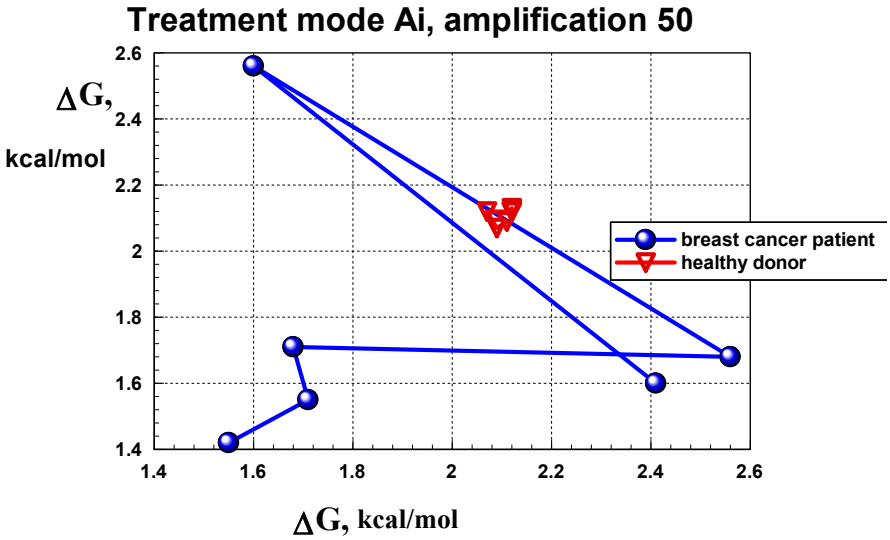

Treatment mode Ai, amplification 50
ΔG, kcal/mol
2.6
2.4
2.2
2
1.8
1.6
1.4
1.4
1.6
1.8
2
2.2
2.4
2.6
ΔG, kcal/mol
breast cancer patient
healthy donor

Fig. 2

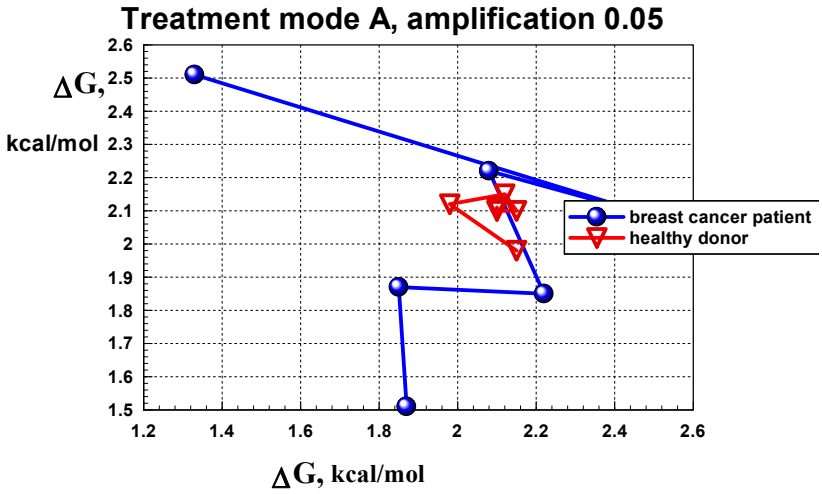

Treatment mode A, amplification 0.05
ΔG, kcal/mol
breast cancer patient
healthy donor
ΔG, kcal/mol

Fig. 3

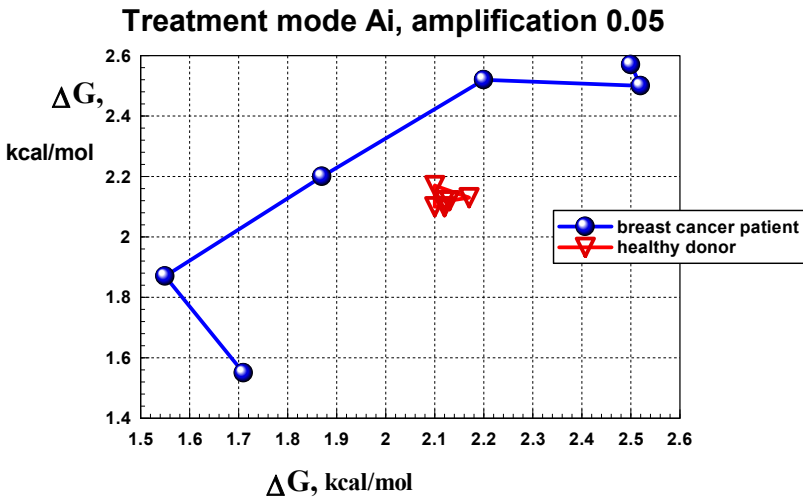

Treatment mode Ai, amplification 0.05
ΔG, kcal/mol
breast cancer patient
healthy donor
ΔG, kcal/mol

Fig. 4

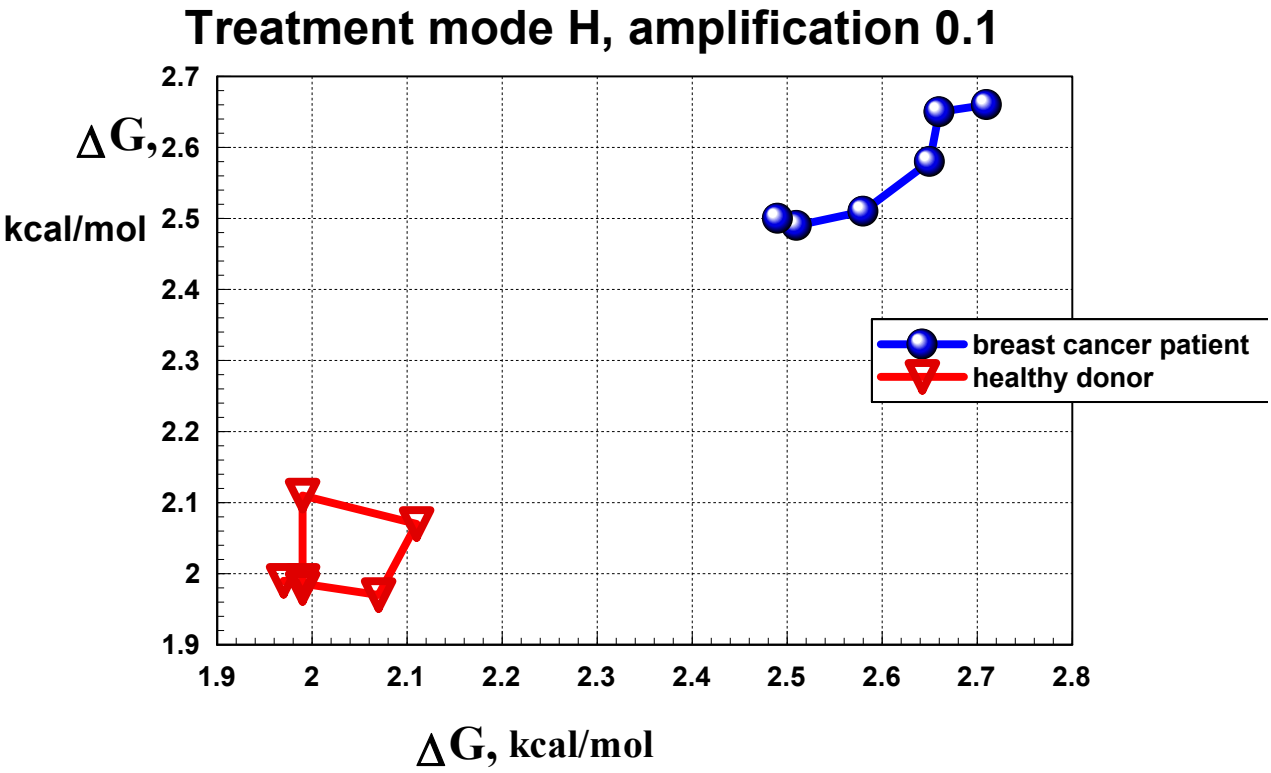

Treatment mode H, amplification 0.1
ΔG, kcal/mol
2.7
2.6
2.5
2.4
2.3
2.2
2.1
2
1.9
1.9
2
2.1
2.2
2.3
2.4
2.5
2.6
2.7
2.8
breast cancer patient
healthy donor
ΔG, kcal/mol

Fig. 5

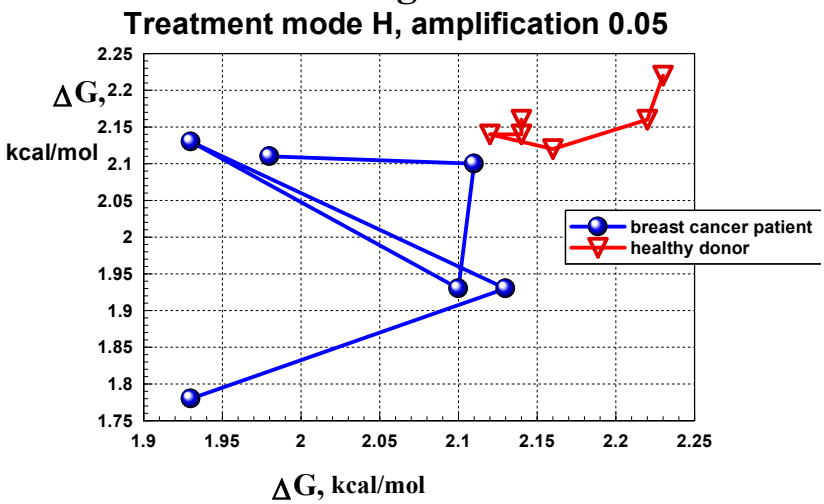

Treatment mode H, amplification 0.05
ΔG, kcal/mol
2.25
2.2
2.15
2.1
2.05
2
1.95
1.9
1.85
1.8
1.75
1.9
1.95
2
2.05
2.1
2.15
2.2
2.25
breast cancer patient
healthy donor
ΔG, kcal/mol

Fig. 6

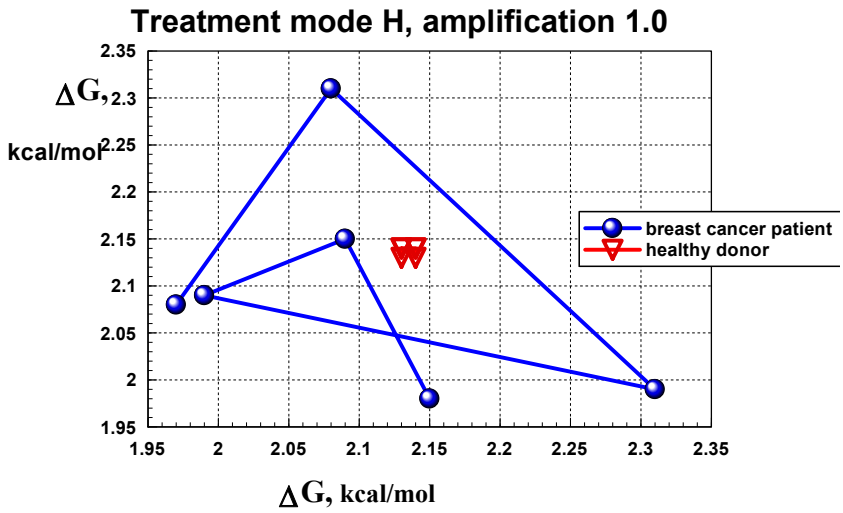

Treatment mode H, amplification 1.0
ΔG, kcal/mol
2.35
2.3
2.25
2.2
2.15
2.1
2.05
2
1.95
1.95
2
2.05
2.1
2.15
2.2
2.25
2.3
2.35
ΔG, kcal/mol
breast cancer patient
healthy donor

Fig. 7

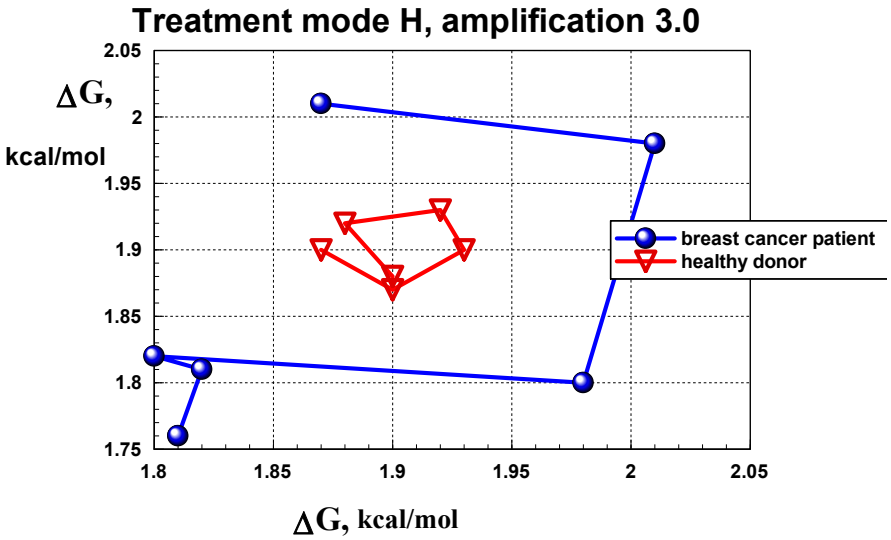

Treatment mode H, amplification 3.0
ΔG, kcal/mol
2.05
2
1.95
1.9
1.85
1.8
1.75
1.8
1.85
1.9
1.95
2
2.05
ΔG, kcal/mol
breast cancer patient
healthy donor

Fig. 8

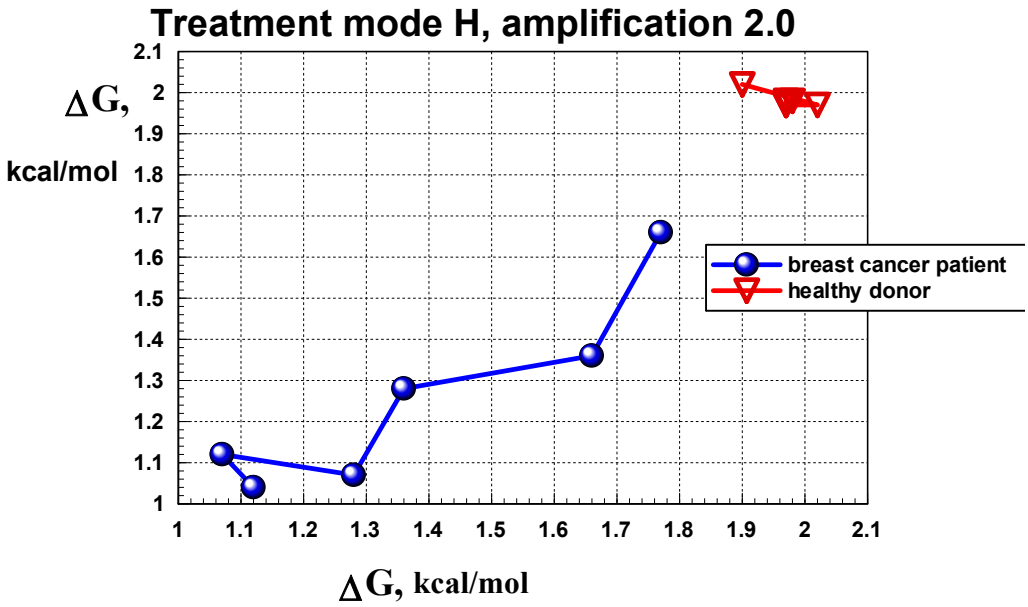

Treatment mode H, amplification 2.0
ΔG, kcal/mol
2.1
2
1.9
1.8
1.7
1.6
1.5
1.4
1.3
1.2
1.1
1
1 1.1 1.2 1.3 1.4 1.5 1.6 1.7 1.8 1.9 2 2.1
ΔG, kcal/mol
breast cancer patient
healthy donor

Fig. 9

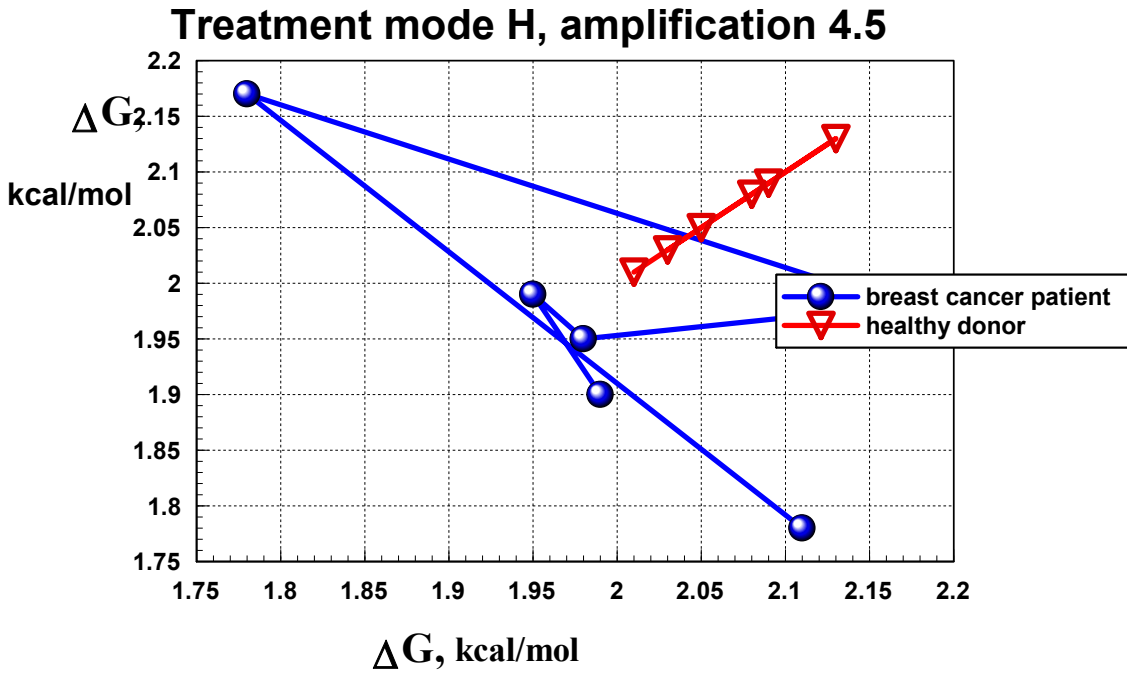
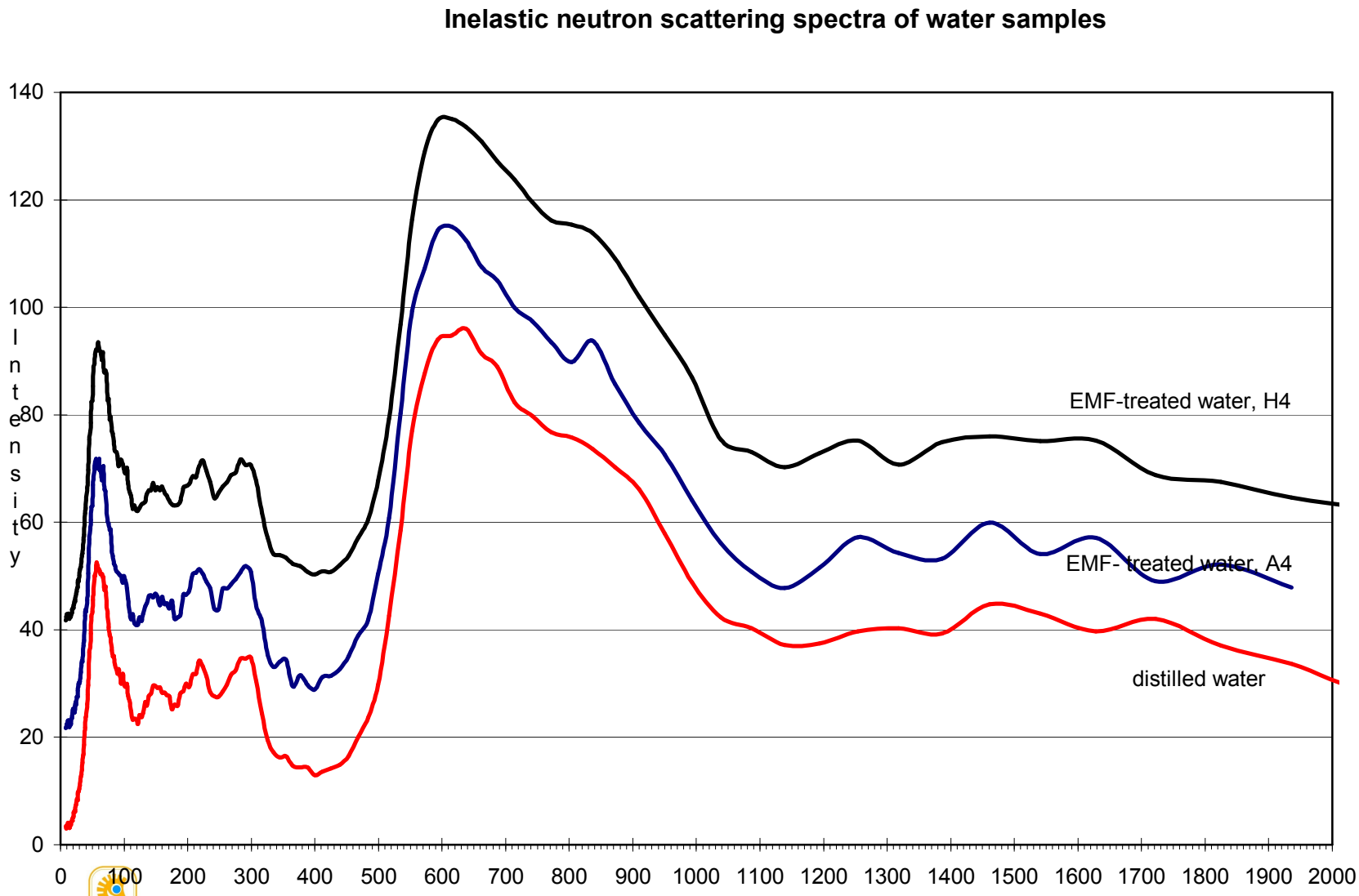

Treatment mode H, amplification 4.5
ΔG, kcal/mol
2.2
2.15
2.1
2.05
2
1.95
1.9
1.85
1.8
1.75
1.75 1.8 1.85 1.9 1.95 2 2.05 2.1 2.15 2.2
ΔG, kcal/mol
breast cancer patient
healthy donor

Fig. 10


Inelastic neutron scattering spectra of water samples
Intensity
0
20
40
60
80
100
120
140
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
1600
1700
1800
1900
2000
Frequency, cm-1
EMF-treated water, H4
EMF- treated water, A4
distilled water

Conclusion

The hierarchy of molecular dynamics in water most probably includes the formation of long range spatio-temporal patterns far from equilibrium.. Conformational movements in biological molecules are adjusted according to these pattern dynamics by their evolution in aqueous medium. The dynamic conformity of supramolecular structures in water and biomolecules is maintained through long range non-specific interactions, hydrogen-bond interactions above all. A network of hydrogen bonds (each of which is an oscillating dipole) generates the electromagnetic field of every particular spatio-temporal pattern in a biological solution. This makes it possible to transfer the dynamic order information within living systems via device-aided transduction of endogenous electromagnetic fields.

This conclusion is proved with the spectra of inelastic neutron scattering (INS) of the frozen water samples. The region from 500 cm^{-1} to 1000 cm^{-1} corresponds to the hydrogen bond vibrations in water. The occurrence of changes in the INS spectra of water treated with endogenous EMF (of *Drosophila melanogaster*) testifies to the involvement of the hydrogen bonding network in the formation of the EEMF imprint in water.

References

1. R. Choy, J.A. Monro, C.W. Smith: Electrical sensitivities in Allergy Patients, Clinical Ecology, 1987, vol. 4, N. 3, p. 93-102.
2. W. Ludwig, Acta Medica Empirica, 4 (1991) 293.
3. W. Ohmine, H. Tanaka, Chem.Rev., 93 (1993) 2545.
4. M. Sasai, A. Ohmine and R. Ramaswamy, J. Chem. Phys., 96 (1992) 3045.
5. V. Danchuk, V. Khavryuchenko, and Yu.Tsyashchenko, Ukrainian Phys.J. (Russ.), 37 (1992) 594.
6. T. Yano, T. Mizuno and H. Kagamiyama, Biochemistry, 32 (1993) 1810.
7. S.J. Slater, C. Ho, F.J. Taddeo, M.B. Kelly and C.D. Stubbs, Biochemistry, 32 (1993) 3714.
8. M. Eckert and G. Zundel, J. Phys. Chem., 91 (1987) 5170.
9. R. Janoschek, E.G. Weidemann and G. Zundel, J. Chem. Soc. Faraday Trans. II., (1973) 505.
10. G. Zundel in A. Pullman (Ed.), Transport through membranes: Carriers, Channels and Pumps, Kluwer Academic Publishers, 1988, p.409.
11. W.C. McCabe, S. Subramanian and H.F. Fisher, J. Phys. Chem., 74 (1970) 4360.