Tesla, Bioresonances and Resonant Recognition Model

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Abstract

Nikola Tesla's work was related to analysis and usage of electromagnetic resonances. Among many of his technical interests he was also interested in bioresonances. His particular interest was in the electromagnetic resonance of the Earth (Schumann Resonance) and the Sun light influence to living organisms. Here, we present some of our earlier work on how Schumann Resonance affects human brain activity, as well as how they are related to acupuncture meridian resonances. We also present here influence and importance of the Sun light and other environmental light to biological processes in living cells, in particular to activity of macromolecules like proteins, DNA and RNA. We have shown that these macromolecular activities/interactions are based on electromagnetic resonances between interacting macromolecules using our own Resonant Recognition Model (RRM).

Keywords: Nikola Tesla; Bioresonances; Resonant Recognition Model.

Introduction

Nikola Tesla was always obsessed with electromagnetic resonances, as he very well knew that resonance is the only way to transfer electromagnetic energy with minimal loss. As he would say: "If you want to find secrets of the universe, think in terms of energy, frequency and vibration.". Most of his discoveries are based on principle of electromagnetic resonances. Along those lines, he was also interested in electromagnetic resonances in living systems. One of his saying was: "Every living being is an engine geared to the wheelwork of the universe. Though seemingly affected only by its immediate surrounding, the sphere of external influence extends to infinite distance." (Tesla in Did the War Cause the Italian Earthquake, New York American, February 7, 1915). Tesla was particularly interested in Earth's electromagnetic resonance that occurs as a set of peaks within extremely low

frequency (ELF) between 3 and 69Hz with distinct peaks at: 7.83, 14.3, 20.8, 27.3 and 33.8Hz. “So astounding are the facts in this connection,” said Tesla in 1899 of the Earth’s electromagnetic resonance – later named Schumann Resonance in 1954, “that it would seem as though the Creator, Himself had electrically designed this planet.”. In our earlier work [1], we have shown explicit correlation between Schumann Resonance and EEG alpha rhythm, as well as with resonances of acupuncture meridians.

In that previous research, we compared the experimental findings from human electrophysiological signal responses to environmental “geomagnetic” and artificial extremely low frequency (ELF) electromagnetic fields in order to determine the transfer characteristic from acupuncture meridian analyses and EEG studies. The fundamental Schumann Resonance frequency is claimed to be extremely beneficial to existence of the biological cycle phenomenon of plants, animals and humans. Along those lines, the results from our acupuncture meridian and EEG activity studies have shown that frequencies between 8.8 and 13.2Hz, which fall within range of the Schumann Resonance, mainly correlate with analysed human electrophysiological signals. The results from our acupuncture meridians and EEG activity studies confirm that the human body absorbs, detects and responds to ELF environmental electromagnetic signals, as presented in Figure 1.

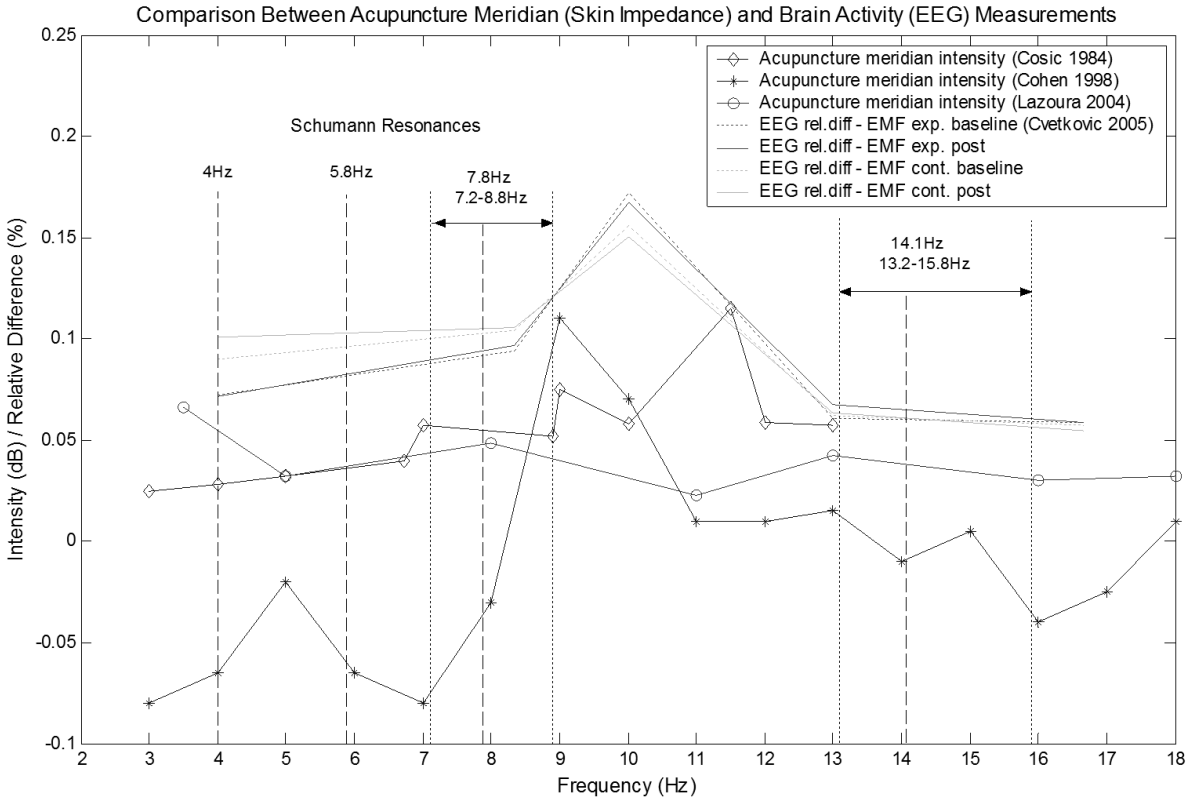

Figure 1. Comparisons between transfer function of acupuncture meridian (skin impedance), brain-wave activity (EEG) and Schumann Resonance. The fixed and

daily fluctuations of Schumann Resonance are indicated at 4, 5.8, 7.8 (7.2-8.8Hz) and 14.1Hz (13.2-15.8Hz) [1].

In our other work [2], we present bioresonance at much higher frequencies involving smaller biological elements: proteins and DNA. In that work, it has been found that protein and DNA resonances are within infra-red, visible and small portion of ultra-violet light, covering the whole range of the Sun light spectrum on the Earth. This work was inspired by Tesla saying: “What is that causes inorganic matter to run into organic forms? It is the Sun’s heat and light.”.

It is well known that the life on the Earth originated and has been sustained by the electromagnetic energy from the Sun light. In primitive organisms and plants the Sun light directly influences biological processes, while in more complex organisms it has more indirect role. In these organisms, due to their more complex structure, the Sun light cannot penetrate into each cell, therefore they have to create their own “internal Sun” energy to drive selectivity of biological processes in their cells, in the same manner as it was originally initiated by the Sun light [3,4].

The selectivity (specificity) of biological processes is driven by the information contained within linear macromolecules: DNA and proteins. While information in DNA is written within the long sequences using different combinations of 4 different nucleotides, information in proteins is also written within long sequences, but using different combinations of 20 amino acids. While DNA carries the complete backup information of any organism, proteins are macromolecules that read the necessary parts of DNA information to actually perform all selective biological activity through a number of very specific interactions. The Resonant Recognition Model (RRM) model proposes that macromolecular selective interactions are based on electromagnetic resonant energy transfer between macromolecules in the range of infra-red, visible and ultra-violet light and thus could mimic specificity enabled by different frequencies (wavelengths) of the Sun light [5,6]. By applying the RRM, it is possible to identify and calculate relevant frequencies critical for resonant activation of specific biological activities of proteins and DNA [7-13].

Here, we discuss:

- Whole RRM spectrum for different biological functions of proteins and DNA;
- Grouping of different biological functions into super families;
- Comparison of RRM spectrum with the water absorption spectrum, spectrum of the Sun light and spectrum of some artificial sources of light;
- Treatment of Crigler-Najjar syndrome by blue light.

Resonant Recognition Model

The RRM is based on the findings that certain periodicities within the distribution of energy of delocalized electrons along a protein/DNA/RNA molecule are critical for protein/DNA/RNA biological function and/or interaction with their targets [5,6,14]. If charge transfer through these macromolecules is introduced, then charge moving through macromolecular backbone can produce electromagnetic radiation, absorption and resonance with spectral characteristics corresponding to the energy distribution [5-10].

The RRM enables the calculation of these spectral characteristics, by assigning each amino acid a physical parameter representing the energy of delocalized electrons of each amino acid. Comparing Fourier spectra for this energy distributions by using cross-spectral function, it has been found that proteins sharing the same biological function/interaction share the same periodicity (frequency) within energy distribution along the macromolecule [5,6]. Furthermore, it has been shown that interacting proteins and their targets share the same characteristic frequency, but have opposite phase at characteristic frequency [5,6,14]. Thus, it has been proposed that the RRM frequencies characterize, not only a general function, but also a recognition and interaction between the particular macromolecule and its target, which then can be considered to be resonant recognition. This could be achieved with resonant energy transfer between the interacting macromolecules through oscillations of a physical field, which is electromagnetic in nature. Since there is evidence that proteins and DNA have certain conducting or semi-conducting properties, a charge moving through the macromolecular backbone and passing different energy stages, caused by different amino acid or nucleotide side groups, can produce sufficient conditions for a specific electromagnetic radiation or absorption. The frequency ranges of this field depend on the charge velocity. The RRM proposes that the charge is travelling through the macromolecular backbone at the estimated velocity of 7.87×10^5m/s [5,6]. For this velocity and with the distance between amino acids in a protein molecule of 3.8Å, the frequency of protein interactions was estimated to be in the range between 10^{13}Hz and 10^{15}Hz. Therefore, the estimated frequency range for both amino acid and nucleotide macromolecules includes infra-red, visible and ultra-violet light. To support this idea, we compared our computational predictions with a number of published experimental results [5,6,10]:

- Laser light growth promotion of cells, by using the particular frequencies of light to produce the similar effect to that of growth factor proteins;
- Chymotrypsin activation (increase of enzyme activity) achieved by laser light radiation in a range of 850-860nm;
- Activation of highly homologous plant photoreceptors which, although being very homologous, absorb different wavelengths of light;

- Photo activated proteins, e.g. rhodopsin, flavodoxin, etc.

These comparisons have shown a strong linear correlation between frequencies, as calculated using the RRM method and experimentally measured characteristic frequencies, with the slope factor of K=201 [5,6,10]. This finding parallels with the frequency range previously associated with the RRM numerical frequency spectrum that has been calculated from the charge velocities through the protein backbone. This correlation can be represented as following:

$$\lambda = K / frrm$$

where λ is the wavelength of light irradiation in nm, which can influence a particular biological process, frrm is a RRM numerical frequency and K is coefficient of this linear correlation.

We applied this concept on a number of proteins and DNA examples [5-10]. The concept has been also experimentally tested by predicting the electromagnetic frequencies for L-Lactate Dehydrogenase [10], where by radiating L-Lactate Dehydrogenase with predicted calculated electromagnetic frequencies the significant change in enzyme activity was achieved. The concept has also been tested independently on experimental measurements of photon emission from dying melanoma cells [11], on photon emission from lethal and non-lethal Ebola strains [12], as well as on classic signalling pathway, JAK-STAT, traditionally composed of nine sequential protein interactions [13].

Keeping all this in mind, we propose that the RRM concept is excellent predictor for proteins and DNA selective interactions, biological processes and pathways in living cells. In our previous work, we have calculated a large number of specific frequencies for different protein and DNA biological functions and interactions.

Environmental Light and Bioresonances of Macromolecules

Functional Super Families

We applied the RRM model on the large number of protein and DNA functional groups and the identified characteristic RRM frequencies are presented in Table 1. The chosen protein and DNA sequences have been predominantly selected based on availability of sequences, proven biological functions and existing experimental results. Therefore, there is a possibility that the new functional groups and related RRM frequencies will appear in future research.

It can be observed from the calculated RRM frequencies, that there are interesting groupings of biological functions into functional super families. For example, it can be observed that protein and DNA functions, that are related to uncontrolled cell growth

super family (like oncogenes, antitumor agents, TNFs, etc.), are all within the frequency range between 0.031 and 0.054, as highlighted in red, in Table 1. Similarly, the super family of viral and bacterial infections are grouped together and highlighted in yellow, the super family related to DNA regulation is highlighted in brown, the super family related to controlled growth is highlighted in pink, while the super family related to enzyme activity is highlighted in green, as presented in Table 1. It appears that there is smaller super family of proteins related to blue light absorption/emission, highlighted in blue, as presented in Table 1. In addition, there are other functional groups that cannot be grouped into the super families at this point, but with more knowledge on protein and DNA sequences and their functions there are possibilities for more super families to be identified.

RRM Frequency	Nano Meters	Functional Group	Super Family
0.002	100K	Circumsporosoite, PfEMP1, EBA, ICHIT (malaria)	
0.0234	20K	Hemoglobin	
0.027	7444	Protein A – VHIII	Tumor regulation
0.031	6484	Antitumor agents (TNF + IL-2 + IFN-beta + human M-CSF)	
0.0313	6422	Oncogenes	
0.039	5154	IL-1	
0.0430	4674	Phospholipases	
0.0439	4579	Insulin multimer	
0.0446	4508	Glucocorticoide receptors	
0.0459	4379	Homeo box proteins	
0.0488	4119	Enhancers	
0.049	4102	TNF receptors	
0.051	3941	TNFs	
0.054	3722	Proto-oncogenes	
0.0590	3407	Cytochrome B	
0.062	3242	EGF- EGF receptor	
0.0703	2859	Neurotoxins	
0.0781	2574	Operators	
0.0820	2451	Interferons	
0.0820	2451	Myoglobins	
0.0839	2396	Bacterial repressors	Viral – bacterial infection
0.0947	2122	Heat shock proteins	
0.096	2094	Tubulins A+B	
0.0990	2030	Repressors	
0.1054	1907	Phage repressors	
0.110	1827	EBA – RBC (malaria interaction with red blood cells)	
0.115	1748	Myxoma virus	
0.162	1241	IGFBP	DNA binding, regulation
0.1685	1193	BRCA1 DNA binding	
0.173	1162	Telomere binding	
0.186	1081	HIV envelope	
0.188	1069	Telomere	
0.2363	851	Chymotrypsins	
0.281	715	Purple (bacteria)	
0.285	705	TERT + telomerase RNA + progerin	Growth
0.288	698	EGFs	
0.289	695	Growth hormons + NGF + proliferins	
0.2929	686	Growth factors (CSF + EGF + IL-2)	
0.297	678	CSF, Ubiquitins, EPA	
0.300	670	IL-2, IL-4, IL-6	
0.308	653	IL-2 – IL2 receptor	
0.3203	628	Glucagons	
0.3281	613	Lysozymes	Enzymes
0.3400	591	Myosins	
0.3437	585	Promoters	
0.3447	583	Trypsins	
0.346	581	Red (rhodopsin)	
0.35	574	RNA polymerase	
0.355	566	Green (rhodopsin & chlorophylls)	
0.3555	565	Protease inhibitors	
0.3770	533	Proteases	
0.379	530	Flavodoxins	
0.3828	525	Insulin receptors	
0.383	525	Insulins	
0.4040	498	NGFs	
0.4121	488	Amylases	
0.4297	468	Kinases	
0.434	463	Tubulins beta	Structural proteins
0.4423	454	Fibrinogens	
0.449	448	Tubulins alpha	
0.4512	445	FGFs, FGF receptors	
0.453	444	IL-12	
0.4609	436	Serine proteases	
0.4687	429	SOS operators	
0.475	423	Blue (rhodopsin & bioluminescent proteins)	Blue
0.4765	422	Cytochrome C	
0.4800	419	Actins	
0.4922	408	ACH receptors	
0.4922	408	IGFs	

Table 1. Characteristic RRM frequencies for different biological functions of protein and DNA macromolecules. Column 1 represents numerical RRM frequency. Column 2 represents the corresponding electromagnetic radiation in nm. Column 3 represents name of functional group of proteins and DNA. Column 4 represents super family of number of functional groups, which are also highlighted in different colours.

The results presented in Table 1 have been also presented graphically in Figure 2, where each RRM frequency range of 0.01 is presented with number of functions within that range. This graphical presentation enables better visualisation of functional groupings of protein and DNA macromolecules based on RRM frequencies. All identified super families have been coloured in accordance to the colours used in Table 1.

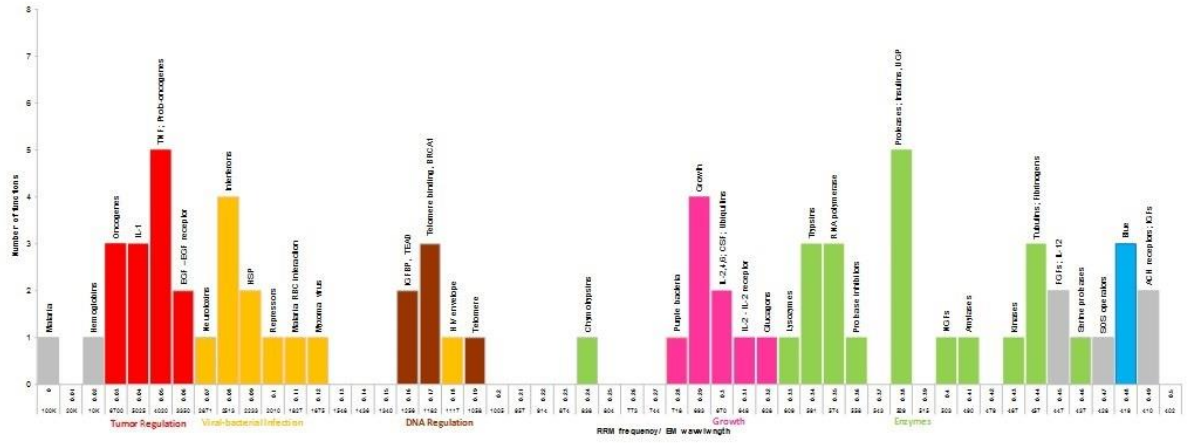

Figure 2. Number of functional groups within each RRM frequency range of 0.01. X axis represent RRM frequency in steps of 0.01, as well as corresponding electromagnetic frequency in nm. Y axis represent number of functional groups. Names of functional groups are written on the top of each bar. Super families are coloured same as in Table 1 and labelled in corresponding colour.

Based on the RRM principle, as described above, the numerical RRM frequencies represent oscillations of electromagnetic field, which are relevant for specific biological functions/interactions. The frequencies of these electromagnetic oscillations are calculated in nm for each biological function and are presented in Table 1, column 2. For each 0.1 of the RRM frequency range, as presented in Figure 2, the corresponding frequencies of electromagnetic oscillations have been calculated in nm and presented along X axis in Figure 2.

As has been presented above, the protein and DNA sequences can be grouped into functional super families, based on the calculated RRM frequencies. The most interesting result is that there are distinct RRM characteristics for uncontrolled and controlled cell growth, which presents an enormous opportunity for understanding cell

transformation and cell growth control. As cancer is defined as uncontrolled cell growth, having the characteristic at molecular level which describes uncontrolled cell growth, gives a new aspect to combat cancer formation and growth. Some preliminary results have experimentally shown that it is possible to use the RRM to design peptides which can interfere with oncogenic transformation [15,16]. The RRM proposes that the characteristic of uncontrolled cell growth is in the specific range of electromagnetic radiation which have been shown by the experimental measurements with cancer tissue [11,17]. In addition, the design of bioactive peptides, using the RRM, have been experimentally tested on examples of cell growth control [18] and vaccine development [19], as well as electromagnetic radiation, as predicted by RRM, can interfere with infections like malaria [20] and ebola [12].

Water Absorption

It can be observed that the whole spectrum of frequencies, as predicted by RRM to be relevant for biological activity of proteins and DNA, are also covering the same spectrum as the spectrum of the Sun light on the Earth's surface, as presented with the yellow line in Figure 3 [21]. This finding was as expected, since the Sun light is the source of all life processes on the Earth. This implies that protein and DNA activity is mimicking the role of the Sun within the biological functions of the cells.

It is also important to note that all biological processes in living cells occur in water medium, which is only transparent for electromagnetic frequencies in the spectrum encompassing mostly visible light, just as predicted by RRM. This means the water medium enables electromagnetic radiation of these frequencies to be transferred between macromolecules without any loss of energy and therefore maximising the efficiency of these interactions.

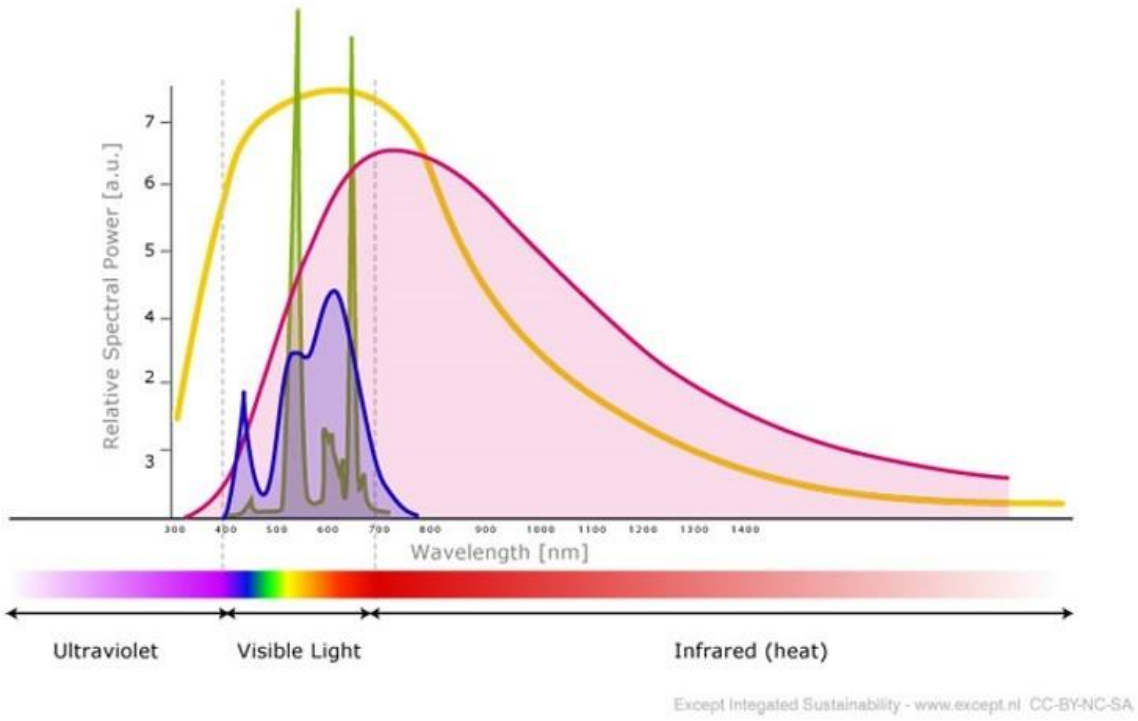

Figure 3. Diagram of the spectrum a LED lamp (blue), a CFL (green) and an incandescent (purple) superimposed the solar spectrum (yellow).

Artificial Light

The frequency range for biological functions has been found to be the same as the frequency range of the Sun light on the Earth, as described above. This reinforces the fact that the life has originated on the Earth and is sourced by the energy from the Sun light. This also means that the environmental Sun light is natural source for the life on the Earth. However, humans are spending more and more time under the artificial light, which may not have the same spectral characteristics as the Sun light and therefore may induce debalance in some biological functions. The spectrum of some artificial light sources has been presented in Figure 3 [21]. It is interesting to note that the incandescent light, as presented with the purple line, has similar spectrum shape as the Sun light. In contrast, the LED light, as presented with the blue line and the CFL light, as presented with the green line have the distinct peaks at certain frequencies within the spectrum, while they are missing many of the other frequencies from the Sun light spectrum.

We have compared the spectrum of LED and CFL artificial lights with the frequencies for particular biological functions, as calculated by the RRM model. It can be observed that the artificial lights have strong radiation relevant for enzyme and control growth activity, while they are missing frequencies related to the tumour regulation and viral-bacterial infections. This finding could lead to possibility that under such artificial lights tumour regulation could be diminished leading to formation of some tumours. In

addition, lack of light frequencies in the range of bacterial and viral infection control could lead to higher susceptibility to these infections. Although, the majority of biological functions within the human organism are protected from electromagnetic radiation within observed spectrum by skin and clothes, these artificial lights might still cause some distortions to biological functions due to the lack of full spectrum of Sun light on humans. For example, there is the experimental evidence that specific photon energies of weak magnetic field of LED wavelength pulses are stored in malignant cells [22].

The Treatment of Crigler-Najjar Syndrome by Blue Light

To test if external light can influence human health we have used the example of the treatment of Crigler-Najjar syndrome by blue light and explained it by Resonant Recognition Model [23]. The Crigler-Najjar syndrome is extremely rare genetic disease affecting the metabolisms of bilirubin, resulting in a form of non-hemolytic jaundice [24]. This disease is caused by lack of expression of UDP glucuronosyltransferase 1-A1. Hence, there is no response to treatment with phenobarbital. The only available treatment is phototherapy, which involves radiation of patients with the blue light for an extensive time every day, usually whole night. Similar treatment is used for jaundice in new born babies.

Here, we have investigated: how and why, the specific blue light radiation can mimic activity of UDP glucuronosyltransferase 1-A1. For that purpose, we used Resonant Recognition Model and we found that specific RRM frequency for UDP glucuronosyltransferase 1-A1 biological function is within the blue light frequency range [23]. This finding explicitly explains, why the blue light can mimic and replace activity of UDP glucuronosyltransferase 1-A1.

We have analysed six HUMAN UDP-glucuronosyltransferase proteins using the RRM and it has been revealed that the common frequency for all analysed sequences is at frequency of f=0.3799±0.0072, as presented in Figure 4.

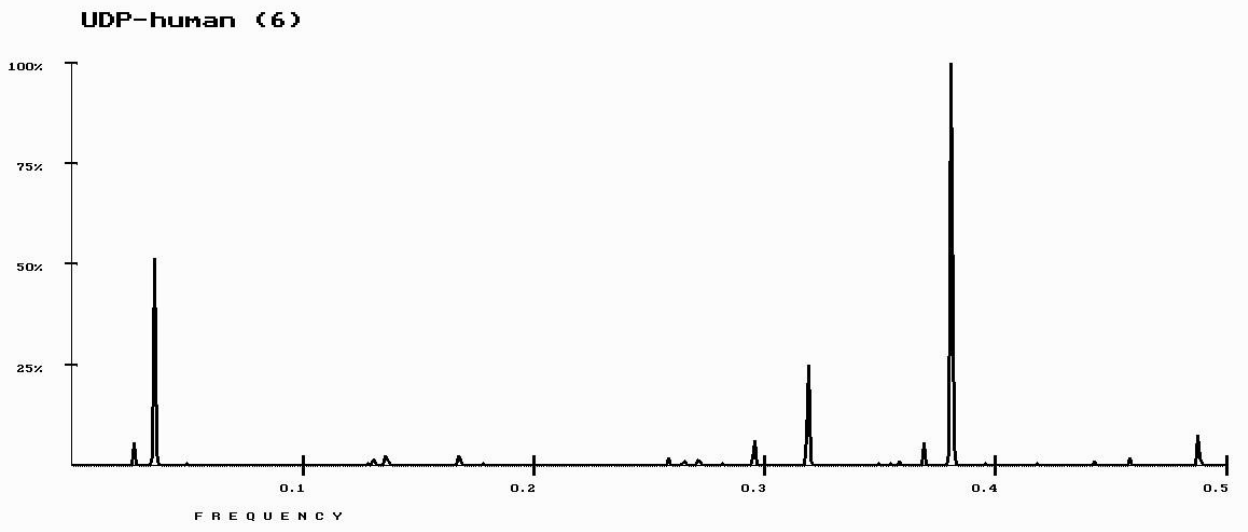

Figure 4. Spectrum for six human UDP proteins showing prominent common peak at frequency of f=0.3799+0.0072.

To make sure that this frequency is related to UDP function in bilirubin metabolism, we have also compared these six human UDP's with beta-barrel protein (angja), that binds bilirubin with high affinity. The result is the more prominent peak at frequency of f=0.3799±0.0072, as presented in Figure 5. This confirms that frequency of f=0.3799±0.0072 is common to UDP's and angja proteins.

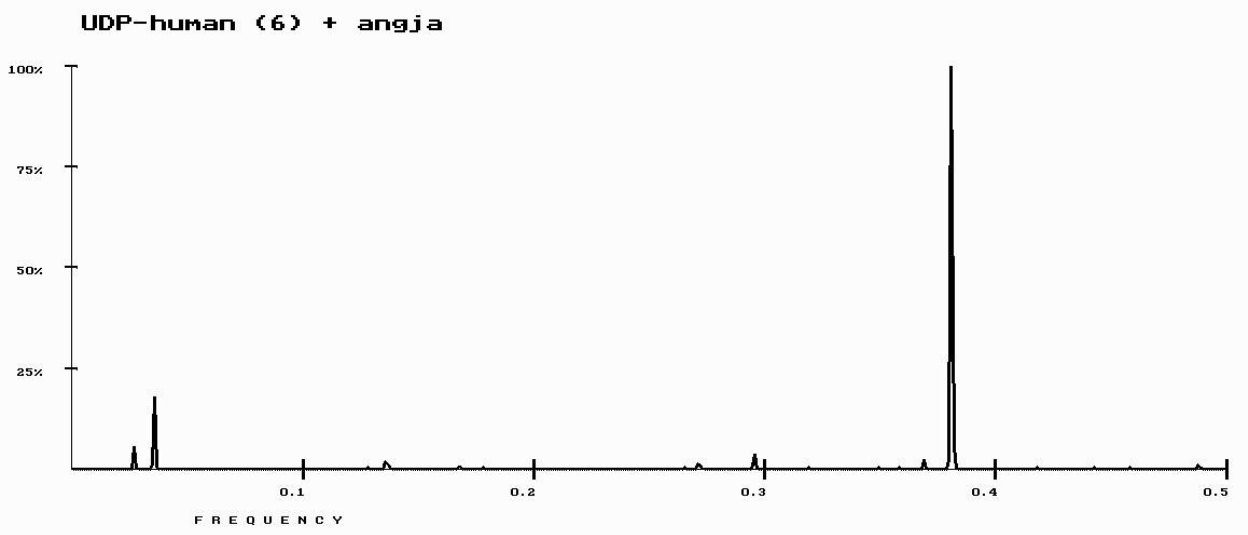

Figure 5. Spectrum for six human UDP proteins together with angja protein showing single prominent peak at frequency of f=0.3799±0.0072.

Thus, we can propose that this characteristic frequency is critical for metabolism of bilirubin. According to RRM this numerical frequency is related to electromagnetic radiation range between 519 and 539nm, calculated as per formula above and encompass with the blue light spectrum, as presented in Figure 6.

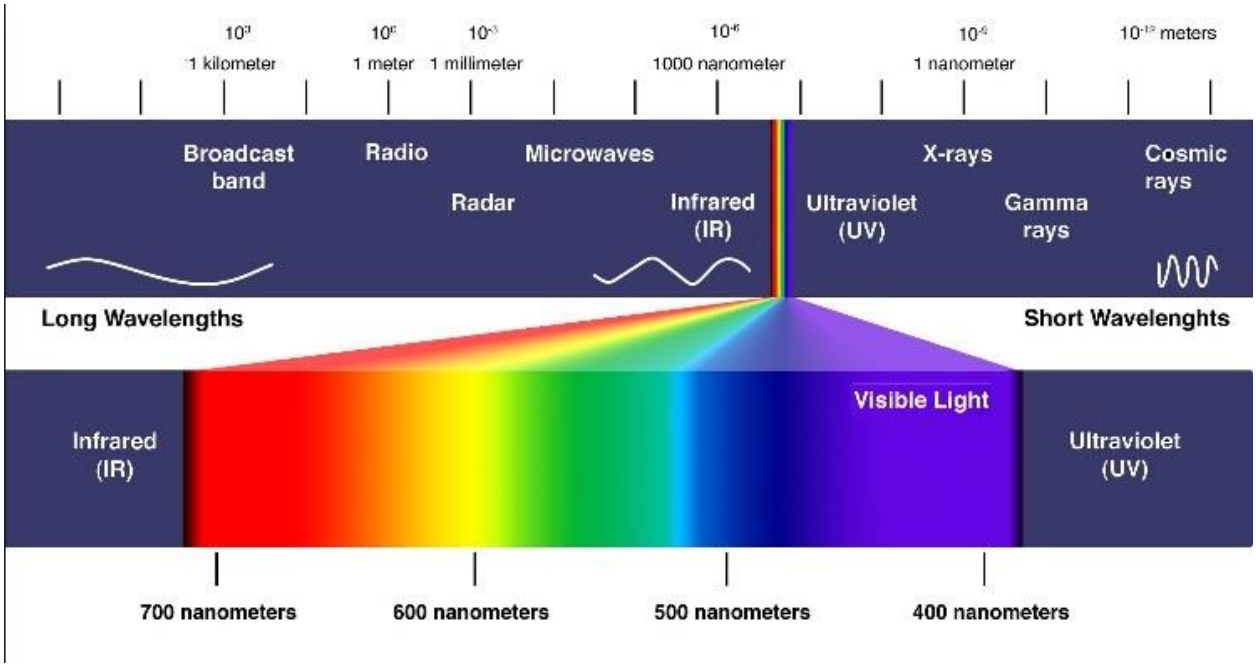

Figure 6. The Electromagnetic Spectrum (from web page: astronomersgroup.org).

Here, we found using the RRM, that characteristic frequency for human UDP's function in bilirubin metabolism is encompassing the blue light radiation. This is crucial finding, that could be the explicit explanation, why phototherapy with the blue light could replace lack of UDP activity. It is for the first time that the RRM could be used in calculating the characteristic frequencies of phototherapy for specific treatments.

Conclusion

This work was inspired by Nikola Tesla saying: "What is that causes inorganic matter to run into organic forms? It is the Sun's heat and light.".

The Sun light electromagnetic radiation was investigated here, as source and influence of biomolecular interactions, related biological functions and consequent health effects. The relationship between our theoretical model, the RRM, and Sun light, as origin of life, gives the possible explanation on how life processes have evolved and are controlled in more complexed organisms, where the Sun light could not penetrate all cells and cellular processes. In addition, although biological processes are currently looked as a large number of different events, we have shown that they are grouped in a relatively small number of general functions enabling the simpler approach to understanding macromolecular interactions, biological functions and related health effects. Along those lines, the role of water and possible influence of artificial light on biological processes has been shown.

To test if external light can influence human health we have used the example of the treatment of Crigler-Najjar syndrome by blue light and explained it by Resonant Recognition Model. The lack of activity of UDP proteins in Crigler-Najjar syndrome is replaced by the blue light phototherapy treatment. We found that human UDP's are characterized by specific RRM frequency that is related to the blue light. This could be the explicit explanation, why phototherapy with the blue light could replace lack of UDP activity.

Having all this in mind, we can conclude that the Resonant Recognition Model (RRM) is a powerful tool in analysis of protein and DNA functions/interactions, which are proposed to be based on resonant electromagnetic energy transfer.

Acknowledgments

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