Possible theoretical basis of biophotons using Resonant Recognition Model

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Summary

There is much evidence of ultra-weak photon emission from biological systems particularly in the range of UVA, visible and near infra-red spectrum ranging from 350 to 1300 nm [1]. Such photon emission is different from bioluminescence, as it is not caused by external stimulation by light. Here we propose, using the Resonant Recognition Model (RRM) that such emission, and particularly its specific frequencies, are critical for resonant activation of specific biological activities of proteins and DNA/RNA.

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. 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 energy distribution.

The RRM enables for these spectral characteristics to be calculated by assigning each amino acid a physical parameter representing the energy of delocalized electrons of each amino acid. Comparing Fourier spectra of 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. Furthermore, it was shown that interacting proteins and their targets share the same characteristic frequency, but opposite phase. 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 [2–3]. This could be achieved through resonant energy transfer between the interacting macromolecules through oscillations of a physical field, possibly electromagnetic in nature. Since there is evidence that proteins, DNA and RNA 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 range of this field depends on a charge velocity. The RRM proposes that charge is travelling through macromolecular backbone at the charge velocity estimated at 7.87×10^5m/s [2-3]. For this velocity and the distance between amino acids in a protein molecule, which is 3.8 Å, the frequency range obtained for protein interactions was estimated to be in the range of 10^{13}Hz up to 10^{15}Hz. Therefore, the estimated 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 [2-3]:

- 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 850-860 nm.
- 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 showed strong linear correlation between frequencies determined using the RRM method and experimentally measured characteristic frequencies, with slope factor of K=201 [2-3]. This finding is in complete agreement with the frequency range previously associated to the RRM numerical frequency spectrum that is calculated from the charge velocities through the protein backbone. This correlation can be represented as follows:

$$\lambda = K / f_{rrm}$$

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

We applied this concept on a number of proteins and DNA/RNA examples [4-6]. The concept has been also experimentally tested by predicting the electromagnetic frequencies for L-Lactate Dehydrogenase. Then by radiating L-Lactate Dehydrogenase with these electromagnetic frequencies the significant change in enzyme activity were obtained [7]. The concept has also been tested independently on experimental measurements of photon emission from dying melanoma cells [8], as well as on photon emission from lethal and non-lethal Ebola strains [9].

Thus, we propose here that RRM concept could be the basis of weak photon emission from biological systems, particularly proteins and DNA/RNA and could be crucial for biological function and selective interaction of these macromolecules.

References:

1. Cifra M, Pospisil P: Ultra-weak Photon Emission from Biological Samples: Definition, Mechanisms, Properties, Detection and Applications, Journal of Photochemistry and Photobiology. B, Biology 2014, doi:10.1016/j.jphotobiol.2014.02.009.
2. Cosic I: Macromolecular Bioactivity: Is it Resonant Interaction between Macromolecules?- Theory and Applications. IEEE Trans on Biomedical Engineering 1994, 41:1101-1114.
3. Cosic I: The Resonant Recognition Model of Macromolecular Bioactivity: Theory and Applications. Basel: Birkhauser Verlag 1997.
4. Cosic I, Lazar K, Cosic D: Prediction of Tubulin resonant frequencies using the Resonant Recognition Model (RRM). IEEE Trans. on NanoBioscience 2015, 12:491-496; doi:10.1109/TNB.2014.2365851.
5. Cosic I, Cosic D, Lazar K: Is it possible to predict electromagnetic resonances in proteins, DNA and RNA?. Nonlinear Biomedical Physics 2015, 3; doi:10.1140/s40366-015-0020-6.
6. Cosic I, Caceres JLH, Cosic D: Possibility to Interfere with Malaria Parasite Activity Using Specific Electromagnetic Frequencies, EPJ Nonlinear Biomedical Physics 2015, doi:10.1140/epjnbp/s40366-015-0025-1.
7. Vojisavljevic V, Pirogova E, Cosic I: The Effect of Electromagnetic Radiation (550nm-850nm) on l-Lactate Dehydrogenase Kinetics. Internat J Radiat Biol. 2007, 83:221-230.
8. Dotta BT, Murugan NJ, Karbowski LM, Lafrenie RM, Persinger MA: Shifting wavelength of ultraweak photon emissions from dying melanoma cells: their chemical enhancement and blocking are predicted by Cosic's theory of resonant recognition model for macromolecules. Naturwissenschaften 2014, 101(2); doi:10.1007/s00114-013-1133-3.
9. Murugan, NJ, Karbowski LM, Persinger MA: Cosic's Resonance Recognition Model for Protein Sequences and Photon Emission Differentiates Lethal and Non-Lethal Ebola Strains: Implications for Treatment. Open Journal of Biophysics 2014, 5:35.