DNA-Wave Biocomputer

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What theory predicts

Several independently developed approaches (see some references at the end of this abstract) to a wave theory of genes have been developed. Here, recent novel experiments, carried out in Moscow, at the Institute of Control Sciences of the Russian Academy of Sciences, are reported in confirmation of this theory. The theory changes the accepted notion about the genetic code essentially, asserting :-

1. that the evolution of biosystems has created genetic "texts", similar to context dependent texts in human languages, shaping the text of these speech-like patterns,
2. that the chromosome apparatus acts simultaneously both as a source and receiver of these genetic texts, respectively decoding and encoding them and
3. that the chromosome continuum of multicellular organisms is analogous to a static-dynamical multiplex time-space holographic grating, which comprises the space-time of an organism in a convoluted form.

That is to say, the action, theory describes, is that of a "gene-sign" laser and its solitone electro-acoustic fields, such that the gene-biocomputer "reads and understands" these texts in a manner similar to human thinking, but at its own genomic level of "reasoning". Thus, it asserts that natural human texts (irrespectively of the language used), and genetic "texts" should have similar mathematical-linguistic and entropic-statistic characteristics, where these concern the fractality of the distribution of the character frequency density in the natural and genetic texts, and where in case of genetic texts, the "characters" are identified, as is the convention, with the nucleotides.

How did this new theory take shape? The principle problem of the creation of the genetic code, as seen in all the approaches, was to explain the mechanism by means of which a third codon in an encoding triplet, is selected. To understand, what kind of mechanism resolves this typically linguistic problem of removing homonym indefiniteness, it is necessary firstly to postulate a mechanism for the context-wave orientations of the ribosomes in order to resolve the problem of a precise selection of aminoacid during protein synthesis. This required that a general informational intermediator function with a very small capacity, within the process of convolution versus development of sign regulative patterns of the genome-biocomputer endogenic physical fields, and lead, secondly, to the conception of the genome's associative-holographic memory and its quantum nonlocality. These assumptions produce a chromosome apparatus and fast wave genetic information channels connecting the chromosomes of the separate cells of an organism into a holistic continuum, working as a biocomputer, where one of the field types, which are produced by the chromosomes, are their radiations. Recent experiments, performed at the Institute of Control Sciences in Moscow, demonstrate this postulated capability of "laser radiations" from chromosomes and DNA. Thus it seems the accepted notions about the genetic code must change fundamentally, and in doing so it will be possible to create and understand this quantum mechanical DNA-wave biocomputer.

What experiment confirms

These wave approaches all require that the fundamental property of the chromosome apparatus is the nonlocality of the genetic information. In particular, quantum nonlocality within the framework of concepts introduced by Einstein, Podolsky and Rosen (EPR). The experiments carried out in Moscow directly relate this quantum nonlocality (i) to laser radiations from chromosomes, (ii) to the ability of the chromosome to gyrate the polarization plane of its own radiated and occluded photons and (iii) to the suspected ability of chromosomes, to transform their own genetic-sign laser radiations into broadband genetic-sign radio waves. In the latter case, the polarizations of chromosome laser photons are connected nonlocally and coherently to polarizations of the radio waves. Partially, this was proved during experiments in vitro, when the DNA preparations interplaying with a laser beam (=632.8 nm), organized in a certain way, polarize and convert the beam simultaneously into a radio-frequency range. In these experiments, another extremely relevant phenomenon was detected: photons, modulated within the polarization by molecules of the DNA preparation. These are found to be localized (or "recorded") in the form of a system of laser mirrors' heterogeneities. Further, this signal can "be read out" without any essential loss of the information (as

theory predicts), in the form of isomorphously (in relation to photons) polarized radio waves. Both the theoretical and experimental research on the convoluted condition of localized photons therefore testifies in favor of these propositions.

These independently research approaches also lead to the postulate, that the liquid crystal phases of the chromosome apparatus (the laser mirror analogues) can be considered as a fractal environment to store the localized photons, so as to create a coherent continuum of quantum-nonlocally distributed polarized radio wave genomic information. To a certain extent, this corresponds with the idea of the genome's quantum-nonlocality, postulated earlier, or to be precise, with a variation of it.

This variation says that the genetic wave information from DNA preparations, recorded within the polarizations of connected photons, being quantum-nonlocal, constitutes a broadband radio wave spectrum correlated - by means of polarizations - with the photons. Here, the main information channel, at least in regard to DNA, is the parameter of polarization, which is nonlocal and is the same for both photons and the radio waves. A characteristic feature is, that the Fourier-image of the radio spectra is dynamical, depending essentially on the type of matter interrogated. It can therefore be asserted, that this phenomenon concerns a new type of a computer (and biocomputer) memory, and also a new type of EPR spectroscopy, namely one featuring photon-radiowave-polarization. The fundamental notion is, that the photon-radio-wave features of different objects (ie the Fourier-spectra of the radio waves of crystals, water, metals, DNA, etc) are stored for definite but varying times by means of laser mirrors, such that the "mirror spectra" concern chaotic attractors with a complex dynamic fractal dynamics, recurring in time. These experiments are therefore not only unique in themselves, they are a first example, that a novel static storage/recording environment (laser mirrors) exists, capable of directly recording the space-time dynamical behaviour of objects. Further the phenomena, detected by these experiments, establishes the existence of an essentially new type of radio signal, where the information will be encoded by polarizations of electromagnetic vectors. This will be the basis of a new type of video recording, and will create a new form of cinema as well.

Further experimental research has revealed the high biological (genetic) activity of such radio waves, when generated under the right conditions by DNA preparations. For example, by means of such artificially produced DNA radiations, the superfast growth of potatoes (up to 1 cm per day) has been achieved, together with dramatic changes of morphogenesis resulting in the formation of small tubers not on rootstocks but on stalks. The same radiations also turned out to be able to cause a statistically authentic "resuscitation" of dead seeds of the plant Arabidopsis thaliana, which were taken from the Chernobyl zone in 1987. By contrast, the monitoring of irradiations by polarized radio waves, which do not carry information on the DNA, are observed to be biologically inactive. In this sequence of experiments, additional evidence was also obtained in favour of the possibility of the existence of the genetic information in form of the polarizational radio wave physical field. This supports the supposition that the main information channel in these experiments is the biosign modulations of polarizations mediated by some version of quantum nonlocality. A well known fact can therefore be seen in new

light, namely, that the information biomacromolecules - DNA, RNA and proteins - have an outspoken capacity to optical rotatory dispersion and circular dichroism. Similarly, the low molecular components of biosystems, such as saccharides, nucleotides, amino acids, porphyrins and other substances have the same capacity; a capacity, which until now made little biological sense. Now, however, this capacity supports, the contention that this newly detected phenomenon of quantized optical activity can be considered as the means by which the organism obtains unlimited information on its own metabolism. That is, such information is read by endogenic laser radiations of chromosomes, which, in their turn, produce the regulative ("semantic") radio emission of the genome biocomputer. Furthermore, the apparent inconsistency between the waves lengths of such radiations and the sizes of organisms, cells and subcell structures is abrogated, since the semantic resonances in biosystems' space are realized not at the level of wave lengths, but at the level of frequencies and angles of twist of the polarization modes. Similarly, this mechanism is the basis for the artificial laser-radio-wave vitro-in vivo scanning of the organism and its components.

Conclusions

This chromosome quantum nonlocality as a phenomenon of the genetic information, is seen as particularly important in multicellular organisms and as applying on various levels.

The 1st level is that the organism as a whole. Here nonlocality is reflected in the capacity for regeneration, such that any part of the body recreates the whole organism, as, for example, in case of worm Planaria. That is to say, any local limiting of the genetic information to any part of a biosystem is totally absent, as also concerns the vegetative reproduction of plants.

The 2nd level is the cellular level. Here it is possible to grow a whole organism out of a single cell. However with highly evolved animal biosystems, this will be a complex matter.

The 3rd level is the cellular-nuclear level. The enucleation of nuclea from somatic and sexual cells and the subsequent introduction into them of other nuclei does not impede the development of a normal organism. Cloning of this kind has already been carried out on higher biosystems, for example, sheep.

The 4th level is the molecular level: here, the ribosome "would read" mRNA not only with respect to the separate codons, but also as a whole and in consideration of their context.

The 5th level is the chromosome-holographic: at this level, a gene has a holographic memory, which is typically distributed, associative, and nonlocal, where the holograms "are read" by electromagnetic and/or acoustic fields. These carry the gene-wave information out beyond the limits of the chromosome structure. Thus, at this and

subsequent levels, the nonlocality takes on its dualistic material-wave role, as may also be true for the holographic memory of the cerebral cortex.

The 6th level concerns the genome's quantum nonlocality. Up to the 6th level, the nonlocality of bio-information is realized within the space of an organism. This 6th level has, however, a special nature; not only because it is realized at the quantum level, but also because it works both through the space of a biosystem and in a biosystem's own time frame. Billions of an organism's cells can therefore "know" about each other instantaneously, allowing such a cell set to regulate and coordinate its metabolism and its own functions.Thus, nonlocality can be postulated to be the key factor explaining the astonishing evolutionary achievement of multicellular biosystems. This factor says that bioinformatic events, can be instantaneously co-ordinated, taking place "here and there simultaneously", and that in such situations the concept of "cause and effect" loses any sense. This is of a great importance! Intercellular diffusion of signal substances and of the nervous processes are far too inertial for this purpose. Even if it is conceded that intercellular transmissions take place electro-magnetically at light speeds, this would still be insufficient to explain how highly evolved, highly complex biosystems work in real time. The apparatus of quantum nonlocality and holography, is in authors' view, indispensable to a proper explanation of such real time working. The 6th level therefore says, genes can act as true quantum objects, and that, it is the phenomemon of quantum non-locality, that ensures organism's supercoherency, information superredundancy, superknowledge, cohesion and, as a totality or whole, the organism's integrity (viability).

Indeed it can be said that this new understanding of biocomputers, constitutes a further step in a development of computer technology in general. An understanding that will bring about a total change of the constituent basis of that technology, in the history of analogue > to > digital > to > now, the figuratively semantic (nonlocal) wave computer or biocomputer. This biocomputer will be based on the higher forms of the DNA memory, and new understanding of the chromosome apparatus, as the recording, storaging, varying and transmitting system for genetic information, that can be considered simultaneously at the level of matter and at the level of physical fields. The latter fields, as showed experimentally in this research, are carriers of genetic and general regulative information, operating on a continuum of genetic molecules (DNA, RNA, proteins). Here, previously unknown types of memory (solitone, holographic, photon/radiowave polarization) and also the DNA molecule itself, work both as biolasers and as a recording environment for these biolaser signals. Thus the genetic code will be essentially different from today's generally accepted but, the DNA-wave biocomputer asserts, incomplete model. For it says that this incomplete model only begins to explain the apparatus of protein biosynthesis of living organisms, providing an important interpretation within the new proposed composite hierarchic chain of material and field, sign, holographic, semiotic-semantic and, in the general case, of figurative, enciphering and deciphering chromosome functions. For in the DNA-wave biocomputer model, the DNA molecules, conceived as a gene-sign continuum of any biosystem, are able to form pre-images of biostructures and of the organism as a whole as a registry of dynamical "wave copies" or "matrixes", each succeeding each other. This continuum is the measuring, calibrating field for the quantum holographic construction in space-time of the biosystem in question.

Some references "Theory of Cybernetic and Intelligent Machine based on Lie Commutators" H.A. Fatmi, M. Jessel, P.Marcer and G. Resconi, International Journal of General Systems, 16,123-164,Appendix.1990; "Order and Chaos in DNA - Denis Guichard Prizewinner: Jean-Claude Perez" Kybernetes, Communications, 21,2, 60-61, 1992 ; "Surreal numbers and optimal computation as a physical process; an interpretation of the genetic code", B.E.P. Clement, P.V. Coveney, P.Marcer, CCAI Journal, 10,1/2, 149-163,1993; Gariaev P.P. "Wave Genome" Public Profit. 279p [in Russian] 1994; "Fractal Presentation of Natural Language Texts and Genetic Code" Maslow M.U., Gariaev P.P., 2nd International Conference on Quantitative Linguistics", QUALICO '94, Moscow, September 20-24, 193-194, 1994 ;Gariaev P.P. etc; "A mathematically specified template for DNA and the Genetic Code in terms of the physically realisable processes of Quantum Holography" Peter Marcer, Walter Schempp, Proc. Symposium "Living Computers" 9th March, University of Greenwich, ed. P.J. Marcer and A. Fedorec, 45-63 1996.