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dedicated to Alexander S. Davydov's 95th birthday

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The biophysical basis of Benveniste experiments

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J Benveniste had observed that highly dilute (and even in the absence of physical molecules) biological agents still triggered relevant biological systems. Some of these experiments were reproduced in three other laboratories who co-signed the article, Nature 333, 816 (1988). Further work, Medical Hypotheses 54, 33 (2000), showed that molecular activity in more than 50 biochemical systems and even in bacteria could be induced by electromagnetic signals transferred through water solutes. The sources of the electromagnetic signals were recordings of specific biological activities. These results suggest that electromagnetic transmission of biochemical information can be stored in the electric dipole moments of water in close analogy to the manner in which magnetic moments store information on a computer disk. The electromagnetic transmission would enable in vivo transmissions of the specific molecular information between two functional biomolecules. In the present work, the physical nature of such biological information storage and retrieval in ordered quantum electromagnetic domains of water will be discussed.

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Human basophil degranulation triggered by very dilute antiserum against IgE

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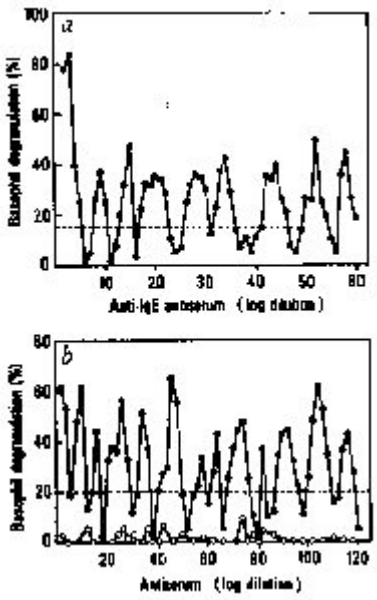
When human polymorphonuclear basophils, a type of white blood cell with antibodies of the immunoglobulin E (IgE) type on its surface, are exposed to anti-IgE antibodies, they release histamine from their intracellular granules and change their staining properties. The latter can be demonstrated at dilutions of anti-IgE that range from 1 X 10^2 to 1 x 10^120; over that range, there are successive peaks of degranulation front 40 to 60% of the basophils, despite the calculated absence of any anti-IgE molecules at the highest dilutions. Since dilutions need to be accompanied by vigorous shaking for the effects to be observed, transmission of the biological information could be related to the molecular organization of water.

The antibodies responsible for human immediate hypersensitivity belong to the IgE isotype. The most salient feature of IgE is its capacity to bind to mast cell and polymorphonuclear basophil membranes through receptors with high affinity. Human are specifically challenged by immunological stimuli such as allergens or anti-IgE antiserum that can bridge IgE molecules in membrane. This process triggers trans-membrane and intracellular signals followed by granule exocytosis with the release of histamine and loss of metachromatic staining of basophil granules by a basic dye such as toluidine blue. Optical basophil degranulation is well correlated with other in vitro and in vivo procedures for the diagnosis of allergy.

In preliminary experiments, degranulation of human basophils contained in leukocyte suspensions was induced not only by the usual concentration of anti-IgE antibody (1*10^3 dilution of anti-IgE antiserum, corresponding to 2.2 X 10^-9 M anti-IgE antibody in the assay), but also by very low concentrations of this antibody (2.2 x 10^16/18 M), where the number of IgG anti-IgE molecules in the assay is supposedly too low to trigger the process. We then further explored this phenomenon.

Serial tenfold dilutions of goat anti-human IgE (Fc) anti-serum (I mg specific antibody per ml) were prepared in HEPES-buffered Tyrode's solution containing human serum albumin (HSA) down to 1 x 10^60 dilution, corresponding to a 2.2 x 10^-66 M theoretical concentration (th) in the assay (see Fig. 1 legend for methods). The expected basophil degranulation, which was assessed by counting cells with metachromatical properties, was observed after exposure of leukocyte preparations to low antiserum dilutions with a maximum at 1 X 10^3 dilution. Successive peaks of degranulation varying between 40 and 60% were then found down to 1 X 10^60 dilution, with periods of 6 to 9 tenfold dilutions (Fig. 1a). In other experiments, the antiserurn was serially diluted a hundred-fold down to 1*10^120 (to give 2.2 x 10^-126 M th in the assay) and similar results were obtained (Fig. 1b). Degranulation induced by high dilutions of anti-IgE antiserum was observed in ten experiments on the full range of dilutions down to 1*10^60, when at least 70 similar results were obtained at one or the other part of the high dilution scale in the participating laboratories (Toronto, preliminary results). As controls, goat antihuman IgG (Fc) antiserum (Fig. 1b, n = 4) or



Tyrode's solution containing HSA (n = 5) were diluted down to 1*10^120 and 1*10^30, respectively. Cells incubated in conditions identical to those with anti-IgE anti-serum gave no significant degranulation. The repetitive waves of anti-IgE-induced degranulation were reproducible, but the peaks of degranulation could shift by one or two dilutions with every fresh sequential dilution of anti-IgE and depended on the blood sample. The waves of basophil degranulation were also seen with substances other than anti-IgE anti-serum at high and low dilutions, such as monoclonal anti-human IgE antibodies, specific antigen in allergic patients or in peroxidase-immunized rabbits, phospholipase A, from bee venom or porcine pancreas, the Na+ ionophore monensin (up to 90% degranulation at 1*10^-30 M th) and the Ca2+ ionophores A23187 and ionomycin (1*10^-38 M th). The specificity of the observed effects at high dilutions (already noted when comparing antiserum against IgE with antiserurn against IgG) was further strikingly illustrated in the ionophore experiments, because removing the corresponding ion from the cellular environment blunted basophil degranulation.

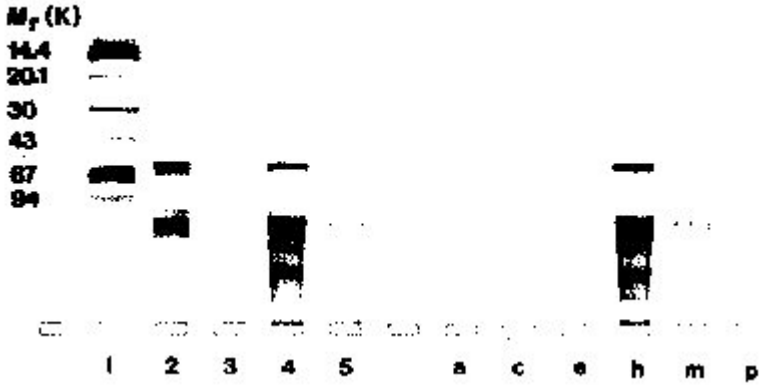
Table 1 : Basophil counts after exposure to anti-IgE antiserum at low and high dilutions.

Samples	Experiment1	Experiment2	Experiment3	Experiment4
Tyrode's-HSA*	81.3+-1.2&	89.0+-3.1	81.7+-2.2	106.7+-1.8
Tyrode's-HSA	81.6+-1.4	87.7+-1.4	83.0+-1.0	105.0+-1.2
Tyrode's-HSA	80.0+-1.5	88.0+-2.3	81.7+-1.8	105.7+-0.9
aIgE 1*10^3*	35.5+-1.8(56)~	42.3+-4.8(53)	27.7+-0.7(66)	40.0+-1.5(62)
aIgE 2*10^32	77.6+-0.8(4)	87.3+-1.2(3)	66.3+-2.3(18)	93.7+-1.9(12)
aIgE 1*10^33	76.0+-1.1(6)	88.7+-1.8(1)	77.7+-1.8(4)	74.7+-2.8(30)
aIgE 1*10^34	53.6+-1.4(33)	52.7+-1.4(41)	38.0+-0.6(53)	48.3+-2.4(55)
aIgE 1*10^35	45.0+-0.5(44)	35.0+-1.0(61)	41.3+-1.8(49)	49.3+-1.2(54)
aIgE 1*10^36	49.0+-1.7(40)	50.3+-0.7(44)	27.7+-0.7(66)	74.3+-2.3(31)
aIgE 1*10^37	79.0+-2.3(2)	85.3+-0.7(5)	73.3+-1.7(10)	105.3+-0.7(0)

Blind experiments: test tubes were randomly coded twice by two independent pairs of observers and assayed. The codes were simultaneously broken at the end of all experiments. Dilutions of anti-IgE antiserurn were performed as described in legend to Fig. 1.
* Uncoded additional tubes for negative (Tyrode's-HSA) or positive (aIgE 1*10^-3) controls.& Data represent the mean ± s.e. of basophil number actually counted in triplicate (see legend to Fig. 1 for methods). ~ Number in parenthesis indicates percentage degranulation compared wilh Tyrode's-HSA

Fig. 1 Human basophil degranulation induced either by anti-IgE anti-serum (*) diluted tenfold from 1*10^2 down to 1*10^60 (a) or hundredfold down to 1*10^120 (b) or by anti-IgG antiserum (0) diluted hundredfold from 1*10^2 down to 1*10^120 (representatives of at least 10 experiments for anti-IgE and 4 experiments for anti-IgG). The significant ($P < 0.05$) percentage of degranulation was 15% (a) and 20% (b). (....) relation to the number of counted basophils from control wells.

Methods Goal anti-human IgE (Fc) antiserum or as a control, goat anti-human IgG (Fc) antiserum (Nordic Immunology, The Netherlands) was serially diluted as indicated above in HEPES- buffered Tyrode's solution (in g l^-1: NaCl, 8; KCl, 0.195; HEPES, 2.6; EDTA-Na, 1.040; glucose, 1 human serum albumin (HSA), 1.0; heparin, 5000 U per 1; pH 7.4). Between each dilution, the solution was thoroughly mixed for 10 s using a Vortex. Given the molecular weight of IgG molecules (150,OOO), the 1*10^60 and 1*10^120 dilutions corresponding in the assay to 2.2*10^-66 M (th) and 2.2*10^-126 (th) respectively. Venous blood (20 ml) front healthy donors was collected using heparin (1 U per ml) and a mixture of 2.5mM EDTA-Na(4)/2.5mM EDTA-Na(2) (final cocentrations) as anticoagulants and allowed to sediment. The leukocyte-rich plasma was recovered, twice washed by centrifugation (400g, 10min) and finally



resuspended in an aliquot of HEPES-buffered Tyrode's solution. The cell suspension (1O µl) was deposited on the bottom of each well of a microtitre plate containing 10 µl CaCl2 (5 mM final) and 10 µl of either of anti-IgE or anti-IgG antiserum dilutions. To a control well were added 10 µl CaCl2 and 10 µl Tyrode's but no anti-IgE or anti-IgG antiserum. Plates were then incubated at 37°C for 30 min.

Staining solution (90 ml; 100 mg toluidine blue and 280 µl glacial acetic acid in 100 ml 25% ethanol, pH 3.2-3.4) was added to each well and the suspension thoroughly mixed. Specifically redstained basophils (non-degranulated basophils) were counted under a microscope using a Fuchs-Rosenthal haernocytometer. The percentage of basophil degranulation was calculated using the following formula: Basophil no. in control - basophil no. in sample/ basophil no. in control X 100. Between 60 and 120 basophils were counted in cell suspensions from control wells after incubation either in the absence of anti-IgE antiserum, or in the presence of anti-IgG antiserum.

To confirm these surprising findings, four blind experiments were carried out (Table 1). In all cases the results were clear-cut, with typical bell-shaped degranulations at anti-IgE dilutions from 1*10^32 to 1*10^37. The replicates were usually very close and of high significance (ANOVA test). In a fifth experiment, 7 control tubes and 3 tubes containing a dilution previously determined as active (1*10^34) were counted blind: basophil degranulation was 7.7 ± 1.4% for the controls, and 44.8, 42.8 and 45.7% for the tubes containing diluted anti-IgE. The random chance in all these experiments was 2% and therefore the cumulative results statistically confirm the measured effect. Two further blind experiments were performed using usual dilution procedure: of the 12 tubes used in the first experiment (Table 2), 2 tubes contained goat anti-human antiserum IgE at 1*10^2 and 1*10^3 dilutions, 6 tubes contained dilutions from 1*10^32 to 1*10^37, and 4 tubes buffer-HSA alone. The tubes were then randomly coded twice by three parties, one of which kept the two codes. The 12 tubes were each divided into 4. Three batches of 12 tubes were lyophilized, one of which was used for gel electrophoresis, one for assay of monoclonal anti-bodies, and the last (with the unlyophilized sample) for gel electrophoresis and basophil degranulation. By comparing the results of the different tests it was easy to identify the tubes containing IgE at normal concentrations compared with the tubes containing highly diluted IgE and the control tubes. When the codes were broken, the actual results exactly fitted those predicted, but HSA and its aggregates were present in all solutions and complicated interpretation of the gel electrophoresis.

Fig. 2 Electrophoresis (polyacrylamide 7-15%, bands revealed by silver staining):samples numbered 1 to 5 are standards for the blind experiments a, c, e, h, m, p Lane 1, Molecular weight standards for electrophoresis; lane 2, monoclonal IgG added with human serum albumin; lane 3, Tyrode's buffer without human serum albumin; lane 4, 1*10^2 anti-IgE dilution; lane 5, 1*10^3 dilution. Samples tested blind: a and c, buffer; e, 1*10^36 anti-IgE dilution; h, 1*10^2 anti-IgE dilution; m,1*10^3 anti-IgE dilution; p, 1*10^35 anti-IgE dilution.

So we performed another almost identical experiment, using 6 tubes containing unlyophilized samples and buffer without HSA. Four tubes contained antibody at 1*10^2,1*1O^3,1*10^35 and 1*10^36 dilutions, and 2 contained buffer alone. These tubes were coded and assayed according to the above protocol. The decoded results were clear-cut, high basophil degranulation being obtained with

1*10^2, 10^3, 10^35 and 10^36 dilutions, but no anti-IgE activity or immunoglobulins were detected either in the control tubes or in assays containing the 1*1^35 and 10^36 dilutions (Tables 2 and 3 and Fig. 2). Thus there is no doubt that there was basophil degranulation in the absence of any detectable anti-IgE molecule.

These results may be related to the recent double-blind clinical study of Reilly *et al.* which showed a significant reduction of symptoms in hay-fever patients treated with a high dilution (1*10^60) of grass pollen versus placebo, and to our *exvivo* experiments in the mouse. We have extended these experiments to other biological systems: using the fluorescent probe fura-2, we recently demonstrated changes in intra-cellular Ca2+ levels in human platelets in the presence of the Ca2+ ionophore ionomycin diluted down to 1*10^39 M th (F. B. et al., unpublished results).

Using the molecular weight of immunoglobulins and Avogadro's number, we calculate that less than one molecule of antibody is present in the assay whep anti-IgE antiserum is diluted to 1*10^14 (corresponding to 2.2*10^20 M). But in the experiments reported here we have detected significant basophil degranulation down to the 1*10^120 dilution. Specific effects have also been triggered by highly diluted agents in other *in vitro* and *in vivo* biological systems, but still remain unexplained. The valid use of Avogadro's number could be questioned, but we are dealing with dilutions far below the Avogadro limit (1*10^100 and below). It could be argued that our serial dilution procedure is subject to experimental error, but this is ruled out because: (1) pipette tips and glass micro pipettes were discarded between each dilution (performed under laminar flow hood). (2) The c.p.m. in tubes containing serially diluted radioactive compounds decreased in propor tion to the degree of dilution down to the background (data not shown). (3) Contamination would not explain the succes sive peaks of activity that evoke a periodic phenomenon and not a monotonous dose-effect curve, as usually observed when concentration of an agonist decreases. (4) To eliminate the possibility of contaminating molecules present in the highly diluted solutions, we carried out two series of experiments which can be summarized as follows. An Amicon membrane with molecular weight cut-off 10K retained the basophil degranulating IgG (150K) present at low dilutions (1*10^2,1*10^3) in anti-IgE antiserum. By contrast, the activity present at high dilutions (1*10^27, 1*10^32) was totally recovered in the 10K Amicon filtrate.

Table 2 Comparison of basophil degranulation with the presence of immunoglobulins and anti-IgE activity in dilutions performed in HSA-containingTyrode's

Samples	Basophil degranulation (%)*			Gel electrophoresis		Anti-IgE activity
	I	II	III	A	B	µml-1
Tyrode's-HSA	0	0	0	-	-	<1 X 10-3
Tyrode's-HSA	0	0	0	-	-	<1 X 10-3
Tyrode's-HSA	0	0	0	-	-	<1 X 10-3
Tyrode's-HSA	0	0	0	-	-	<1 X 10-3
aIgE 1 X 10-2	53	50	33	++§	++	ND
aIgE 1 X 10-2	51	44	37	++	++	10.6
aIgE 1 X 10-3	65	38	45	+?	-	1.1
aIgE 1 X 10-32	7	26	22	-	-	<1 X 10-3
aIgE 1 X 10-33	37	0	13	-	-	<1 X 10-3
aIgE 1 X 10-34	45	37	20	-	-	<1 X 10-3
aIgE 1 X 10-35	39	41	34	-	-	<1 X 10-3
aIgE 1 X 10-36	31	29	39	-	-	<1 X 10-3
aIgE 1 X 10-37	23	12	29	-	-	<1 X 10-3

Blind experiments and dilution protocols as in Table 1. -, Lack of strained bands. ND, not determined. A faint band corresponding to IgG appeared after reduction by 2-mercaptoethanol.

* Basophil degranulation tests I, II, III were performed using 3 different blood samples (see Fig. 1). Percentage basophil degranulation induced by aIgE, as compared to Tyrode's HSA, was calculated from duplicates. ° Electrophoresis (polyacrylamide 7-15%, revealed by silver staining) was carried out in Rehovot (A) and at INSERM U 200 (B). £ Uncoded additional tube for positive control.

§ ++,+ Bands correspond to IgG present in large or small amounts.

Anion or cation exchange chromatography,according to the type of resin used

and the pH, did or did not retain the anti-IgE IgG at low dilutions, whereas the same activity at high dilution was always excluded from the columns and fully recovered in the first eluate. These filtration and ion-exchange experiments demonstrated that the activity of the antiserum at high dilution cannot result from contamination of the highly diluted solution with the starting material. They showed, in addition, that the high-dilution activity does not present in space the steric conformation of an IgG molecule as it acts like a 150K charged molecule, but is not retained by the 10K filter or by a charged chromatography column. We then investigated the physical chemical nature of the entity active at high dilution. Our results can be summarized as follows. (1) The importance of agitation in the transmission of information was explored by pipetting dilutions up and down ten times and comparing with the usual 10-s vortexing. Although the two processes resulted in the same dilution (degranulations at 1*10^2 and 1*10^3 were superimposable whatever the dilution process), degranulation did not occur at high dilution after pipetting. Ten-second vortexing was the minimum time required, but vortexing for longer (30 or 60 s) did not increase high-dilution activity. So transmission of the information depended on vigorous agitation, possibly inducing a submolecular organization of water or closely related liquids. (2) The latter is possible as ethanol and propanol could also support the phenomenon. In contrast, dilutions in dimethylsulphoxide did not transmit the information from one dilution to the other, but increasing the proportion of water in dimethylsulphoxide resulted in the appearance and increment of the activity at high dilutions. (3) Heating, freeze-thawing or ultrasonication suppressed the activity of highly diluted solutions, but not the activity of several active compounds at high concentrations. A striking feature was that molecules reacted to heat according to their distinctive heat sensitivity, whereas all highly diluted solutions ceased to be active between 70 and 8O°C. This result suggests a common mechanism operating at high dilution, independent of the nature of the starting molecule. Therefore we propose that none of the starting molecules is present in the dilutions beyond the Avogadro limit and that specific information must have been transmitted during the dilution/shaking process. Water could act as a 'template' for the molecule, for example by an infinite hydrogen-bonded network, or electric and magnetic fields. At present we can only speculate on the nature of the specific activity present in the highly diluted solutions. We can affirm that (1) this activity was established under stringent experimental conditions, such as blind double-coded procedures involving six laboratories from four countries; Table 3 Comparison of basophil degranulation with the presence of immunoglobulins and anti-IgE activity in dilutions performed in Tyrode's without HSA.

Samples	Basophil degranulation (%)		Gel electrophoresis		Anti-IgE activity
	I	II	A	B	µml-1
Tyrode's	0	0	-	-	<1 X 10-3
Tyrode's	0	0	-	-	<1 X 10-3
aIgE 1 X 10-2*	85	48	++	++	ND
aIgE 1 X 10-2	81	47	++	++	32.6
aIgE 1 X 10-3*	ND	ND	+	+	ND
aIgE 1 X 10-3	75	53	+	+	ND
aIgE 1 X 10-35	35	31	-	-	<1 X 10-3
aIgE 1 X 10-36	40	35	-	-	<1 X 10-3

* Uncoded tubes for positive control of basophil degranulation and/or gel electrophoresis.
ND, not determined.

(2) it is specific for the ligand first introduced, as illustrated when goat antiserum (IgG) anti-human IgE, but not goat IgG anti-human IgG supported this phenomenon. The link between high and low anti-IgE dilutions is shown as we could not detect basophil degranulation at high dilutions if it did not occur within the classical range. High dilutions of histamine, but not of its carboxylated precursor histidine, inhibited IgE-dependent basophil degranulation. Finally, ionophores at high dilution did not work when the specific ion was removed from the cell suspension (F.B., unpublished results). (3) Using six biochemical and

physical probes, we demonstrated that what supports the activity at high dilutions is not a molecule. (4) Whatever its nature, it is capable of 'reproducing' subtle molecular variations, such as the rearrangement of the variable region of an IgG (anti-E versus anti-gamma) molecule. The precise nature of this phenomenon remains unexplained. It was critical that we should first establish the reality of biological effects in the physical absence of molecules. The entities supporting this 'metamolecular' biology can only be explored by physical investigation of agitation causing interaction between the original molecules and water, thus yielding activity capable of specifically imitating the native molecules, though any such hypothesis is unsubstantiated at present. We thank Professor Z. Bentwich from Ruth Ben Ari Institute for supervision of experiments conducted in Rehovot. The participation of J. Geen (Univ. Toronto), B. Descours and C. Hieblot (INSERM U 200) in experiments and of V. Besso in editing is gratefully acknowledged. This work is dedicated to the late Michel Aubin, who played a decisive role in initiating it.

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Editorial reservation

READERS of this article may share the incredulity of the many referees who have commented on several versions of it during the past several months. The essence of the result is that an aqueous solution of an antibody retains its ability to evoke a biological response even when diluted to such an extent that there is a negligible chance of there being a single molecule in any sample. There is no physical basis for such an activity. With the kind collaboration of Professor Benveniste, Nature has therefore arranged for independent investigators to observe repetitions of the experiments. A report of this investigation will appear shortly.

СЕКЦИЯ Q. БИОФИЗИЧЕСКИЕ ОСНОВЫ НОВЫХ МЕДИЦИНСКИХ ТЕХНОЛОГИЙ

УДК 577.3.043 + 578.616.57.017

Q.1. ВЛИЯНИЕ ВЕКТОРНОГО ПОТЕНЦИАЛА НА РЕПРОДУКЦИЮ ВИЧ В КУЛЬТУРЕ Т-ЛИМФОЦИТОВ ПЕРИФЕРИЧЕСКОЙ КРОВИ ЧЕЛОВЕКА

Покидышева Л.Н., Трухан Э М., Титова И.В., Миллер Г.Г.

Q.1. INFLUENSE OF A VECTOR POTENTIAL ON A HIV REPRODUCTION IN T-LYMPHOCYTES IN VITRO

Pokidysheva L.N., Trukhan E.M., Titova I.V., Miller G.G.

The examination of a field free vector potential (VP) influence on HIV reproduction in a T-lymphocytes in vitro is presented. Two variants of the tissue culture cells, infected by HIV were used: a human peripheral blood Tlymphocytes
(PBL) and a human T-lymphoblastoid cell line MT4. The cultures were exposed to a VP during 0,5 and 1,0 hour before or after they were infected by 100 units per cell of a lymphotropic strain of HIV(R5/LAV-1). Some effect of a VP on the mentioned above biological systems was revealed. Some distinctions of cell proliferation index (PI) between the PBL and MT4 were found. Slight increase of PI in PBL may be conditioned by wide presentation of signal Toll-2 (IL-1) receptors on the cell surface, which induce the expression of early dividing genes, whereas they are very rare on the surface of MT4 cell line. However the viral pathogenicity was higher in a MT4 cell line. The phenomena required subsequent evaluation.

Пандемия СПИДа, продолжающаяся в течение вот уже 28 лет, до сих пор остается самой тревожной и загадочной проблемой в инфекционной патологии человека. За минувший период времени не удалось достичь каких-либо значимых успехов в лекарственной терапии ВИЧ-инфекции и СПИДа. Подводя итоги прошедших лет на XIV Всемирной Конференции по СПИДу, которая состоялась в августе 2007 г. в Австралии, UNAIDS продекларировала коренное изменение стратегии борьбы с этим заболеванием и рекомендовала исследовательским центрам обратить особое внимание на поиски средств физического и/или биологического воздействия на ВИЧ. Такой инновационный подход, очевидно, потребует длительных испытаний, поскольку речь пойдет об индукции физическими методами биологических изменений в пораженных клетках организма. ВИЧ-инфекция, как известно, летально поражает в первую очередь клетки иммунной системы периферической крови – Т-лимфоциты. По этой причине, не только прямое воздействие на вирус, но также и манипулирование иммунными реакциями зараженной клетки, в основном, в направлении сохранения выживаемости и усиления ее защитных функций, возможно, могли бы помочь противодействовать размножению вируса. Следовательно, есть необходимость в широком поиске специфических физических и/или биологических эффекторов для воздействия на клеточные функции, атакуемые вирусом иммунодефицита.

Представленное сообщение посвящено изучению влияния векторного потенциала на определяющие биосинтетические процессы в главных клетках мишенях для ВИЧ – Т-лимфоцитах периферической крови человека и на особенности репродукции в этой системе вируса иммунодефицита.

Векторный потенциал представляет собой физическую субстанцию, формирующую магнитное поле. Однако в пространстве распределения векторного потенциала могут содержаться области, свободные от магнитного поля. Векторный потенциал в этих областях называют безроторным или безполевым векторным потенциалом (БВП). Этот потенциал не способен оказывать прямое силовое воздействие на материальный объект, но может влиять на фазы волновых функций заряженных частиц и в некоторых случаях изменять их пространственное распределение. Такое информационное (сигнальное) воздействие может служить инструментом косвенного влияния на структуру термодинамически неравновесных систем и на скорости химических и биохимических процессах в них за сч□т энергии самого объекта. Ранее [1,2] было установлено влияние БВП на ряд физико-химических и биологических объектов. В частности, обнаружено воздействие БВП на скорость оседания эритроцитов, фагоцитарную активность макрофагов, реакцию антиген-антитело, индекс стимулированной митогенами пролиферации лимфоцитов, репарационные процессы в поврежд□нных клетках. Во многих случаях обнаруженное действие БВП имело терапевтическую направленность. В связи с этим данное исследование представляет определ□нный теоретический и практический интерес. Устройство источника БВП было описано ранее [1,2]. Оно представляет с о б о й специальную конструкцию из постоянных магнитов, формирующих область БВП об□мом около 100 см

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СОДЕРЖАНИЕ

СЕКЦИЯ S. КВАНТОВАЯ ЭЛЕКТРОДИНАМИКА КОНДЕНСИРУЮЩИХСЯ СРЕД И МЕДИКО-БИОЛОГИЧЕСКИЕ ПРОБЛЕМЫ

УДК 611; 612

S.1. НАНО-ЭЛЕМЕНТЫ ИЗ ПАТОЛОГИЧЕСКИХ МИКРООРГАНИЗМОВ

Монтаньер Л.

S.1. NANO-ELEMENTS FROM PATHOGENIC MICROORGANISMS

Montagnier L.

There are many ways by which infectious agents can persist in their host, despite an adequate immune response of the latter and the medical use of strong inhibitors of their replication. Retroviruses have evolved to find the best solution in order to persist silent in the host cell by integrating their DNA into the cell DNA. But bacteria have also learned how to stay almost indefinitely in tissues or organs in a resting state, insensitive to antibiotics and poorly exposed to immune reactions. It is also a general property of pathogenic microorganisms to adapt their genome very rapidly to any targeted reaction against them, either endogenous (immune response) or exogenous (treatment). I will describe some new phenomenons occurring in bacteria and viruses which may contribute to the chronicity of many diseases and to the difficulties of eradicating their infectious origin.

The first is what can be best defined as genetic dispersion. When a mycoplasma suspension is filtered through filters of 100 and 20 nM, which are pore sizes much lower than the average size of these micro-organisms (300 nM), the filtrate is apparently sterile when it is cultured in synthetic medium or analysed by DNA PCR and nested DNA PCR. However when the filtrate is incubated with human T lymphocytes (previously checked for lack of infection by the mycoplasma), we detect again the resurgence of the mycoplasma with all its characteristics after 2 or 3 weeks of culture, even when the filtrate is diluted down to 10^{-6}.

Our current interpretation is that nanostructures existing in the filtrate each contain a piece of genetic information which can eventually reconstitute a whole infectious genome with the help of eukaryotic cells. This led us to explore the nature of such nanostructures and to discover another puzzling phenomenon, which may or may not be related to the first one: it is the generation of electromagnetic waves of low frequency (1000 to 5000 Hertz) by the filtrates of some bacterial species and viruses in appropriate aqueous dilutions. It is in fact a resonance emission subsequent to excitation by very low frequencies coming from the electromagnetic background. Classical pathogenic bacteria such as E. Coli, Staphylococcus, Streptococcus, Clostridium, etc., as well as mycoplasma and viruses like HIV, are sources of the structures emitting the signals. These signals are approximately all similar, although a more refined analysis may find species-specific differences. The plasmas of individuals chronically infected by the same agents also yield similar signals. The nature and significance for pathogenesis of

the molecules involved will be discussed.

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S.2. ДАЛЬНЕЙШЕЕ ИССЛЕДОВАНИЕ ДЕЙСТВИЯ СЛАБЫХ КОМБИНИРОВАННЫХ МАГНИТНЫХ ПОЛЕЙ НА ВОДНЫЙ РАСТВОР ГЛУТАМИНОВОЙ КИСЛОТЫ

Джулиани Л., Гримальди С., Энрико Д'Эмилиа А. Л., Бобкова Н, Жадин М.

S.2. FURTHER INVESTIGATION OF ACTION OF WEAK COMBINED MAGNETIC FIELDS ON AQUEOUS GLUTAMIC ACID SOLUTION

Livio Giuliani, Settimio Grimaldi, Antonella Lisi, Enrico D'Emilia, Natalia Bobkova, Mikhail Zhadin

In this work the results of the known investigation (Zhadin et al., 1998) of the influence of combined static (40 μT) and alternating (amplitude of 40 *nT*) parallel magnetic fields on the current through the aqueous solution of glutamic acid, were successfully replicated and further investigated. The experiments were carried out by the application of the combined magnetic fields to the solution placed into a plexiglass reaction vessel at application of static voltage to golden electrodes placed into the solution. Some experiments were also carried out by the application of the combined magnetic fields to the solution placed in a plexiglass reaction vessel, without electrodes, within an electric field, generated by means of a capacitor at the voltage of 27 mV. The frequency of the alternating field was scanned within the bounds from 1,0 *Hz to 6,0 Hz* including the cyclotron frequency corresponding to a glutamic acid ion and to the applied static magnetic field. In these experiments the prominent peaks with half-width of 0.5-0.9 *Hz* and with different heights (till 80 *nA*) were registered at the alternating magnetic field frequency equal to the cyclotron frequency (4.2 *Hz*). The general reproducibility of the investigated effects was 70% among the all solutions studied by us and they arose usually after 40–60 min after preparation of the solution. In some made-up solutions the appearance of instability in the registered current was noted in 30–45 min after the solution preparation. This instability endured for 20–40 min. At the end of such instability period the effects of combined fields appeared practically every time.

В задачу данной работы входило дальнейшее развитие нашего прежнего исследования (Zhadin et al., 1998) действия комбинированных слабых постоянного и переменного магнитных полей на проводимость водного раствора глутаминовой аминокислоты. В плексигласовую ячейку, в которую наливался свежеприготовленный водный раствор глутаминовой кислоты с концентрацией 0,38 $мг/мл$ и изоэлектрической точкой '32,89, мы помещали два золотых плоских электрода на расстоянии около 10 $мм$ друг от друга. Опыты велись при постоянной температуре раствора 22ºС. К электродам прилагалось постоянное напряжение 27 $мВ$. Параллельные постоянное (40 $мкТл$) и переменное (40 $нТл$) магнитные поля
создавались приложением соответствующих напряжений к соленоиду, внутри которого размещалась ячейка с электродами и глутаминовой кислотой. Ячейка и соленоиды размещались в камере, экранированной пермаллоем от внешних постоянных и переменных магнитных полей. Регистрировался ток через электроды, размещенные в ячейке. Компьютер, управлявший ходом эксперимента, и аккумулятор, обеспечивавший постоянное напряжение, так же как и сами экспериментаторы во время хода опыта располагались вне камеры. Циклотронная частота задавалась по известной формуле, где q – заряд и m – масса иона глутаминовой кислоты без учета гидратной оболочки иона, как это обычно принималось в опытах с комбинированными магнитными полями, а B_0 – постоянное магнитное поле внутри соленоида. При нашем $B_0 = 40$ $мкТл$ циклотронная частота иона глутаминовой кислоты была равна '34,2 $Гц$. Частота переменного
поля сканировалась от 1 $Гц$ до 6 $Гц$ (или от 2 $Гц$ до 6 $Гц$ в некоторых опытах) так, чтобы длительность экспозиции каждой частоты была равна 1,5 сек., что обеспечивало достаточное время для развития циклотронного резонанса.

Ожидаемый эффект обычно развивался через 40-60 мин. после приготовления раствора и обычно возникал несколько раз при повторении предъявления циклотронной частоты в процессе ряда сканирований. Ширина такого пика на его полувысоте была в пределах 0,5 $Гц$ – 0,9 $Гц$. Типичный пик резонансного увеличения тока через раствор приведен на рис. А. Пики имели несимметричную форму с подъемом, более крутым по сравнению с пологим спадом. Величина пика обычно в несколько раз превосходила значение фонового тока через раствор. В целом по всем выполненным опытам такая форма резонанса наблюдалась в

40% опытов. Это было в два раза выше вероятности возникновения таких эффектов в наших первоначальных опытах (Zhadin et al., 1998) и в экспериментах, поставленных (Del Giudice et al., 2002; Pazur, 2004; Comisso et al., 2006) с целью воспроизведения эффектов, полученных в нашей первоначальной работе.

Эти различия, очевидно, были обусловлены более внимательным отношением к выявлению условий возникновения искомых эффектов. В настоящей работе в ряде опытов мы также вместо электродов использовали индукционные катушки вокруг ячейки для регистрации изменений электрического тока в растворе. В этих опытах приблизительно с той же вероятностью возникали пики индукционных токов. Пример такого эффекта приведен на Рис. В. Это исключало идею (