ACTION OF COMBINED MAGNETIC FIELDS ON A NEAR-EARTH ASTRONAUT

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Развитие представлений о биологическом действии магнитных полей

Середина 20 века – магнитные поля практически не действуют на биологические системы.

До 1985 года – действуют при величинах 50-100 миллиТесла, вызывая слабое головокружение и т.п.

С 1985 по 1994 гг. – слабые комбинированные поля на уровне десятков микроТесла при циклотронной частоте резонансно действуют на живые системы. Научное сообщество встретило эти работы с недоверием.

С 1994 г. – сверхслабое на уровне наноТесла переменное магнитное поле в комбинации со слабым постоянным полем резонансным образом действуют на водные растворы аминокислот.

The situation in Bioelectromagnetics in 90-th

In 1985 Liboff and Blackman et al. discovered unusual resonance effects of simultaneous weak (several tens of μT) DC and low frequency AC magnetic fields (MFs) at the cyclotron frequency metal ions - calcium, potassium, and magnesium.

OUR MAIN RESULTS

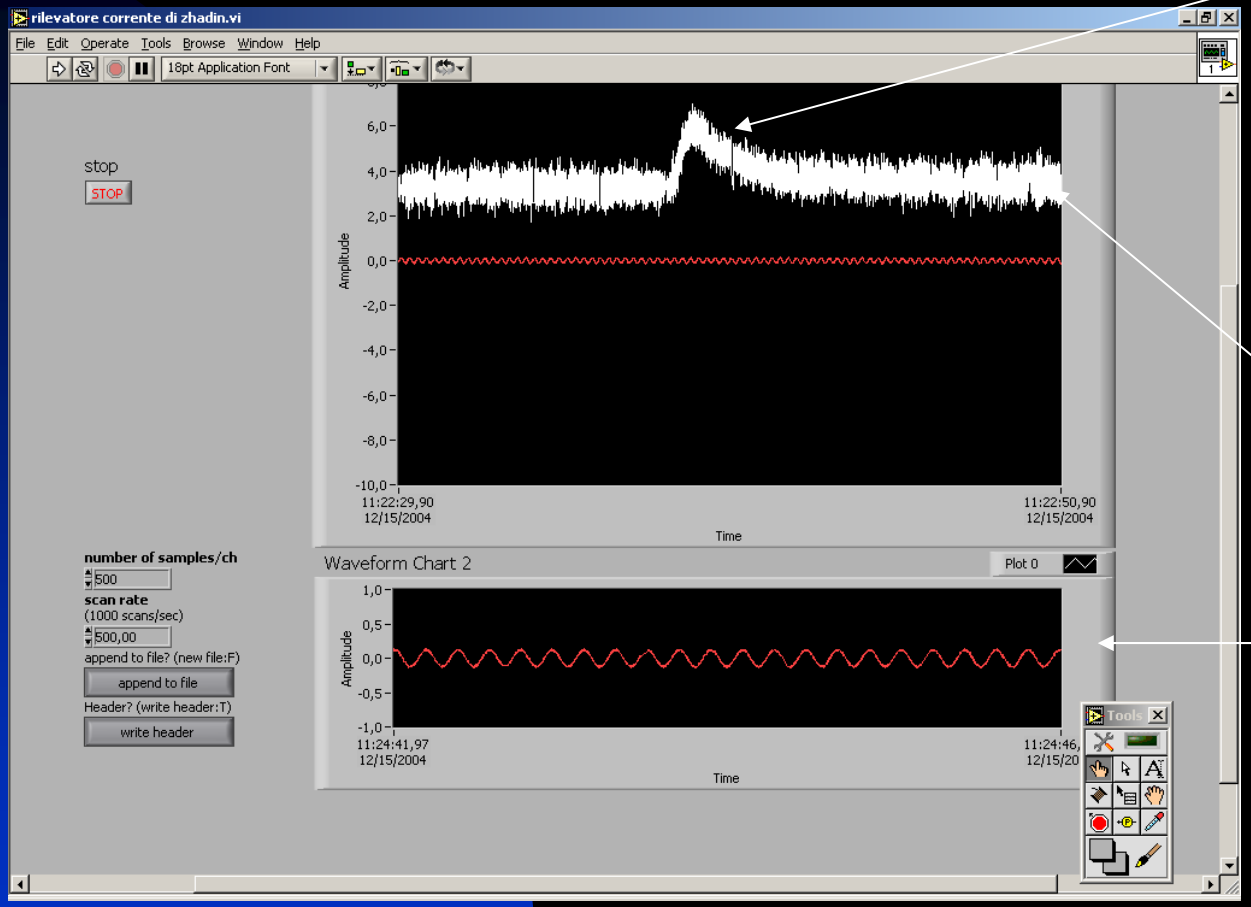
- The prominent effect at the AC MF several tens of nT in the form of narrow resonance peak in solution of α-aminoacids was observed (Novikov and Zhadin, 1994; Zhadin et al., 1998.)

These results were replicated by Del Giudice et al. (2002) and Comisso et al. (2006) in Italy, and Pazur (2004) in Germany

- A theory of action of combined MFs on thermal motion of an ion within a macromolecule or microcrystal was elaborated on bases of classic physics (Zhadin, 1998) and now on the bases of quantum electrodynamics (Zhadin and Giuliani. 2006, Zhadin, 2009 in press)

Resonance peak in the current through the solution

Glutammic acid



effect

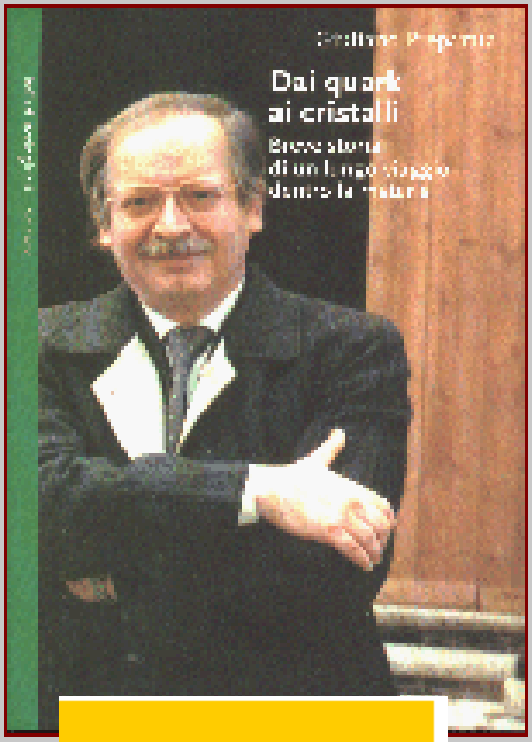
Baseline current

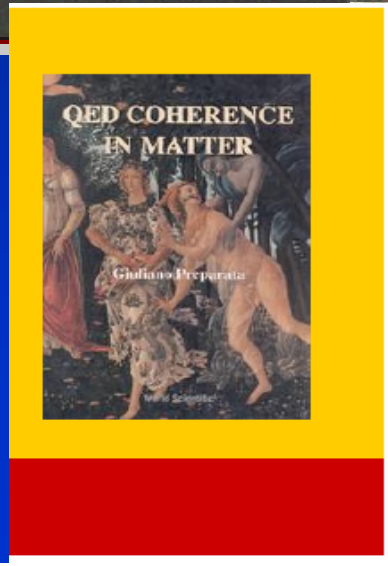
Applied sin field

Experimental parameters 4.17Hz

48uT Bo 48nT B

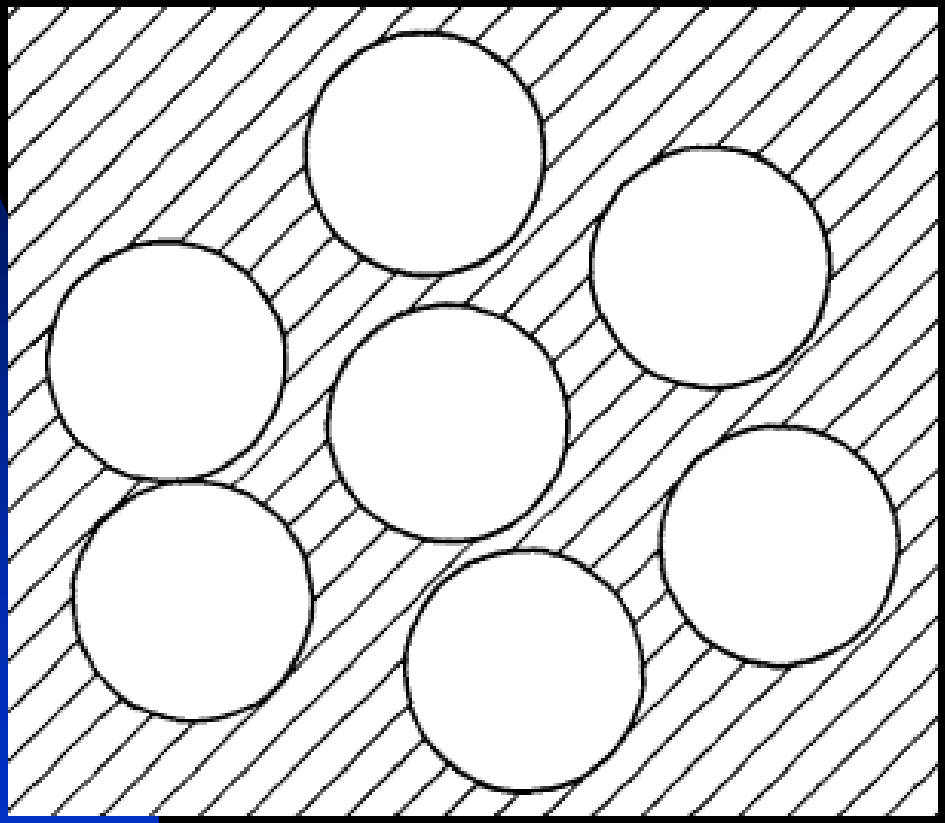
Development of Preparata's ideas





1) How and in what forms do the amino acid ions enter inside coherence domains (CDs)?
2) How do they participate in formation of coherent oscillations of molecules within CDs?
3) What is the mechanism of successive cyclic change in different ionic forms in the solution under the influence of MFs?

Домены когерентности в окружающей их некогерентной среде



Mixed CDs in aqueous amino acid solution

One of important feature of α-Amino acid ions in the aqueous solution are existence of four isometric forms depending on pH.

At pH~3 glutamic acid ions have a zwitteerionic form, that is dipole

At the forming of CDs zwitterions captured by them.

$$HOOCCH_2CH_2CH(NH_3)^+COO^-$$

At pH~7 zwitterionic form transform into the usual ionic form

$$HOOCCH_2CH_2CH(NH_3)^+COOH$$

MFs increase kinetic energy of these ions and withdraw them out of CDs

What molecules are able to participate in mixed CDs forming?

Resonant frequencies of all 20 alpha amino

Acids lay in the range 1-15 Hz of solar magnetic

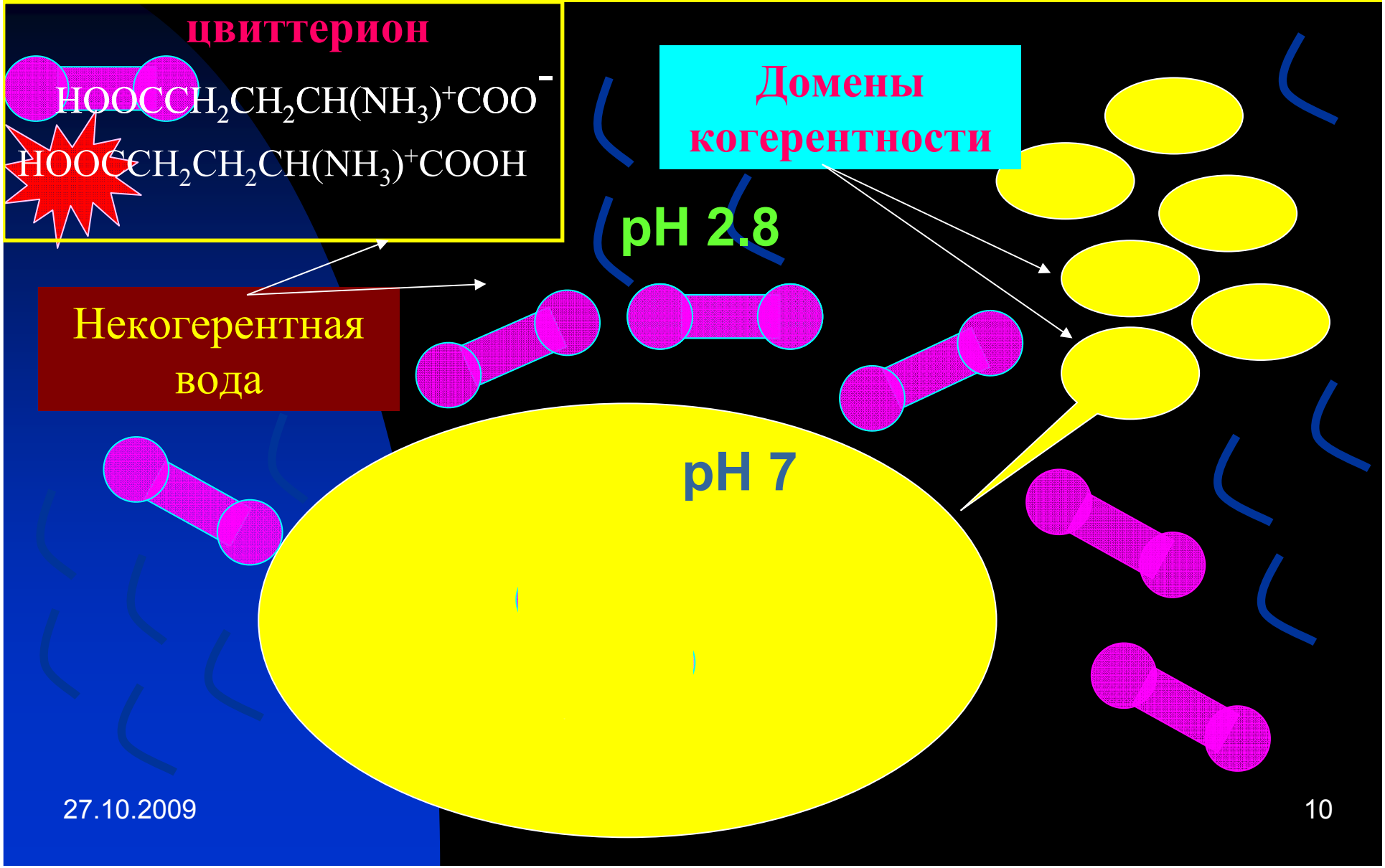
activity. All of them are spectrum-compatible with water molecules.

The molecules with specific spectral features.

- The molecules with changeable ionic forms.
- When the macromolecule is bigger than CDs, the CD sits on them.

4. Mixed CD can bind two macromolecules or two parts of the same macromolecule

Циклическая смена ионных форм глутаминовой кислоты под действием комбинированных магнитных полей



Роль слабых магнитных полей в жизни организма

Высокая скорость каталитических реакций несовместима с медленной диффузией в некогерентной среде. Только в ДК могут протекать такие процессы.

Карбоксильная и амино- группы способствуют обмену между некогерентной и когерентной компонентами.

Сверхслабые переменные поля, настроенные на указанные группы, способствуют протеканию ферментативных реакций и взаимодействию между когерентной и некогерентной средами.

Космонавтика и биологическое действие комбинированных МП

- При полете космического корабля вокруг Земли с периодом 1,5 часа происходит быстрое циклическое изменение резонансной частоты для каждой из всех α-аминокислот, что препятствует развитию адаптации космонавта. При многомесячном пребывании в околоземном пространстве это может стать причиной серьезных последствий для его здоровья. Однако последнее утверждение требует экспериментальной проверки, которую можно сделать в лабораторных условиях на Земле.

Thank you for your attention,

my dear friends !

Experimental installation

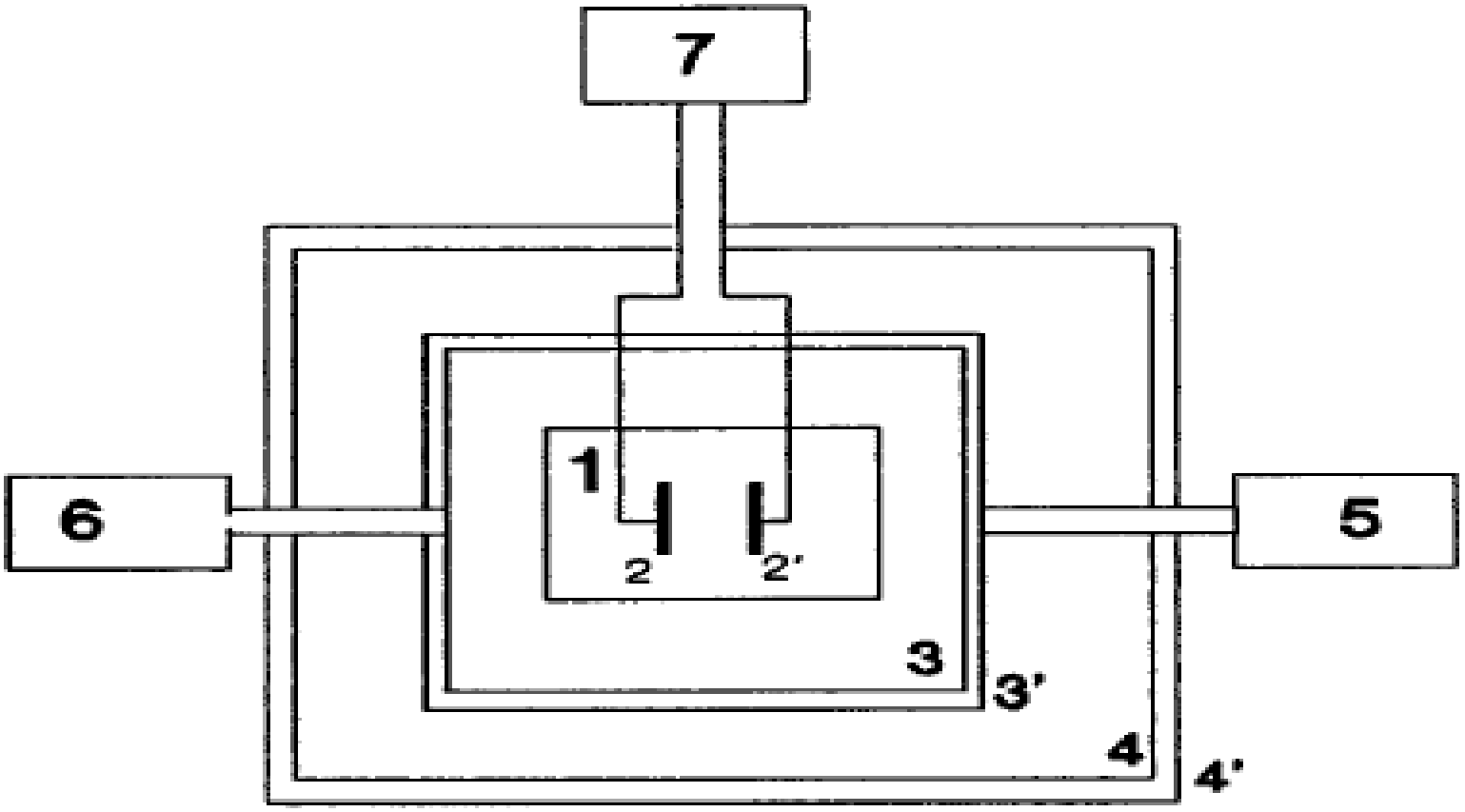


Fig. 1. Experimental installation. 1-Cuvette with solution. 2-Electrodes. 3-Solenoid coils. 4-Magnetic screen of Permalloy. 5-Direct voltage source. 6-Sine-wave generator. 7-Measuring block: stabilizer of electrode voltage, current meter, recorder.

Preparata's theory of MFs influence on conductivity in aqueous solution

In their brilliant work (Del Giudice et al., 2002) they studied the motion of amino acid ions in coherence domains (CDs} where the coherent water has essentially reduced viscosity. They showed that under the influence of DC MF the ions rotate along CDs borders without loss of their kinetic energy, constantly suffering internal reflectance, and that AC MF with the cyclotron frequency corresponding to charge-to-mass ration of the given ions leads to the gradual increase in the energy of these ions and to their escape from the CDs to the incoherent surrounding medium. These processes cause the short-term increase of the current through the exposed solution. Thus all main objections of critics of this line in Bioelectromagnetics were overruled.

Resonance peak (Liboff et al. 1987. In “Mechanistic approaches to interaction of electric and electromagnetic fields with living systems". N Y: 109)

Half-width is about 5 Hz

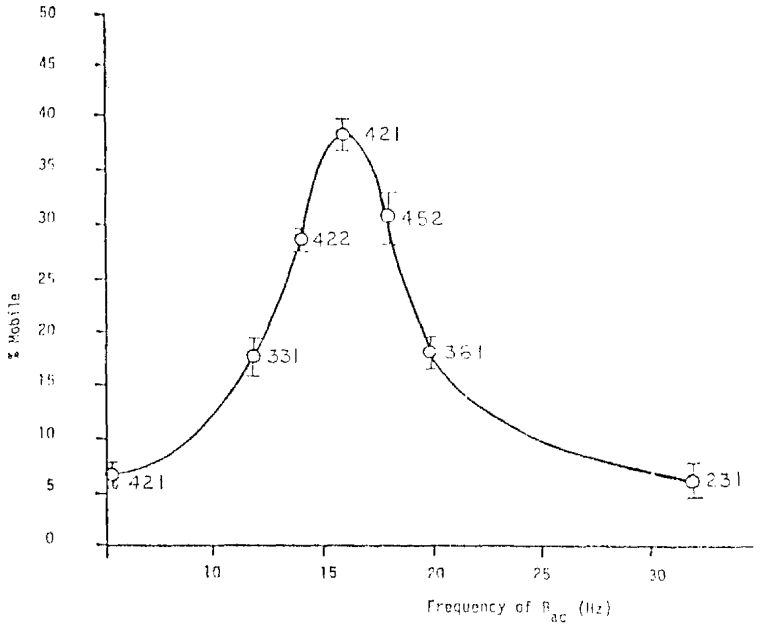


Fig. 13. The motility of diatoms as a function of magnetic field frequency. For one fixed magnetostatic field 0.209 g, the ac magnetic field frequency is varied, and a clear maximum is obtained at the CR frequency for Ca^{2+}, namely, 16 Hz. The half-width of this resonance is about 11 Hz.

Our experiments with amino acid solutions

In the beginning of 90-th we performed a series of experiments for investigation of action of weak low frequency AC MF combined with parallel DC MF on an aqueous solution of an amino acid. The value of DC MF was chosen to be close to the geomagnetic one (about 40 μT). In the experiments we measured the value of an electric current passing through the solution.

A bridge between QED and Medicine

Giuliano Preparata and his coworkers elaborated a QED theory of condensed matter. Finishing the description of main ideas G. Preparata wrote (Preparata, 2000. Rivista di Biologia/ Biology Forum 93: 467-512),

"I shall end this presentation by briefly describing what the new physics has been able to build of the first section of the bridge towards Medicine. This section will concentrate on three arches:

1. the new physics of water;
2. a possible origin of coherence in cell tissues;
3. the interaction of very weak, low frequency magnetic fields with the ions' systems of the cell."

(ii)