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Demetrio P. Errigo

The simulation model of a complex system: the neural system

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A. Pitasi *(profpitasi@gmail.com)*

He is tenured Professor of Legal systems and Social Complexity at Gabriele D'Annunzio University of Pescara (Italy), and due to his position he has been part of the Statute Commission of the same University, according to Law Gabriele D'Annunzio. Being a systems sociologist, he is implementing researches, scenario analysis a policymaking planning in the field of the development of the abilities of a legal systems to attract capitals (financial, intellectual, human ones, etc.). He is Honorary Life President of the World Complexity Science Academy (www.wcsaglobal.org) and he is author of dozens of scientific publications, both in Italian and in English, among which the most recent and relevant ones are "Teoria sistemica e complessità morfogenetica del capitalismo" (Systems theory and morphogenetic complexity of capitalism) (2010), "The Hyperhuman World" (2011 also in a French edition). From 1999 he collaborates with the prestigious World Futures review directed by Ervin Laszlo and published by Taylor and Francis for which he has been Guest Editor of the three volume book: "Future Trends of Communication Strategies" (2001) and of the forthcoming: "Contemporary Sociological Theory and the Key Challenges of Our Times".

M. R. Astolfi *(mra@cyberbrain.eu)*

She is a Systemic Psycho-Pedagogist and a Human Resources Independent Researcher. She graduated in Foreign Literature and Languages (English and French) and in Pedagogy with an Experimental Pedagogy thesis. She is also specialized in Special Pedagogy. She is expert in Communication, Structuralism, Systems, Models, Methodology and Didactics. And she is the author of several publications. She is lecturer in workshops, conferences and conventions, some organized by her. She was Practice Fellow in English Language at the Economy and Commerce Faculty of in the University of "Ca' Foscari" in Venice, Language and Communication and Special Pedagogy teacher in several training course. For several years she was President of engineering and of an advanced service sector companies and later she applied to Personal Selection and Formation. She is Co-Founder and President of WCSA (World Complexity Science Academy, www.wcsaglobal.org) and she is also member of the Club of Budapest Research Committee. She is joint owner and Editorial Manager of some publications: "Nuova Atlantide", (the WCSA Review on the theory systems and complexity); "Nature e Culture" (on Culture, Science and Philosophy) and "New Life" (on the systemic Global Vision). She is also Editorial Manager of the "www.cyberbrain.eu" website.

G. Balsamini *(balsamini@autec-it.eu) graduated in Electronic Engineering (Bologna University) with a thesis on Industrial Applications. Now he is co-owner in chief of the Company AUTEC srl. in Fusignano (Ra), Italy, and free researcher of Soft and Hard Systems. As prevailing activity he is interested in advanced electronic technology experimentations for innovator projects and, in particular, in highly sophisticated hardware projects in R&D. His research and application sectors vary among the sensor applications, the ultrasounds and the CAD models of similar-biological systems and their spin off. He is WCSA Co-Founder member and Directive Board Member.*

L. Berardi *(berardi@autec-it.eu) after his specific studies in the sector, for many years he has been applying himself to the advanced electronics ad to innovator projects and now he is also free researcher of software and hardware applied systems. He is co-owner in chief of the company AUTEC s.r.l. in Fusignano (Ra), Italy, from 1986 in which he projects and realize electronic systems with very high technological contents, as for instance the "Stereotactic helmet", used for human brain operations for the Parkinson's disease treatment, and informatics models of similar-biological systems and their spin off. He is WCSA Co-Founder and Directive Board Member.*

The simulation model of a complex system: the neural system

***Demetrio P. Errigo* (1)**

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1. ABSTRACT

The object of this study was to create an elementary electronic circuit which can produce signals that are similar to those produced by intracellular and extra-cellular circuits, a hardware that works autonomously with no need of an external software because it self-creates it. In this paper I describe an artificial, and/or bionic, neural structure formed by the simulation of modular similar-analogic electronic elements for generating and/or re-establishing correct communication between components of a biological structure, in particular a nervous system. I present a series of data, which derive from a simulation of what becomes a very simple electronic and informational elementary circuit. This circuit is extrapolated from many other circuits which are supported by a universal model and, working together, give coherent answers and are able to help or replace a neuron or a group of neurons. The simulated structure includes a plurality of modular electronic devices interconnected together to form at least one pair of meshes and is able to generate analogic electrical signals of various waveforms and various electric powers. I have so realized an simulator system as a quasi-Boolean net, but functional only, because the omni-directional reaction to an operative, at a perturbation level action, gives origin to different functionalities in a similar structure, which exists in a non-digital way, or, it might be better to say, which lives in an analogical quasi-digital way, with molecular code and decode factors, to which, at present, I approximate in an quasi-complete way. I have obtained an almost perfect correlation between those signals that are generated in nature and those that we have artificially produced. I have demonstrated that, to build a real and working artificial intelligence, or a particular part of it, we must preliminarily plan an "opposite-engineering" system that, starting from the biological and not "vice/versa", can, in the meantime, define the *"how"*, hoping it becomes even the *"why"*. The fundamentals ideas that lead to the new electro-informatics model construction are examined either from a theoretical point of view (that is the basis for my researches and which describes the production and the direction bus of the informative signals) and from the point of view of the structure realization.

2. KEYWORDS (in alphabetical order)

Automata; Chaos; Complexity; Cyborg; Models; Neurons; Robotics; Systems; Uncertainty.

3. INTRODUCTION

3.1 The Progress Report

In my researches, in quality of "observing systems' observer", I was always highly interested in cybernetics and its evolving in Bio-cybernetics (see Note 3 - CyberNeuroPhisiology). Moreover, as a researcher, I was the more and more concerned in Bionics in a pertinent analysis's constant need and recognizing the importance of correct methodologies. At the same time I tried to delineate a comprehensive outline of my theoretical position in comparison and in function of most of the last century and today's theoretician Scientists and Scholars (see References).

It's starting from their experimental researches, in particular on the problem of a potentially convertible and/or analyzable nervous system, that these influential Scientists and Scholars, who have enormously contributed to its knowledge evolution (and not only in the field of Biology and Cybernetics), have answered to my numerous questions just to let me plan the global frame of my work.

They make me understand what I consider the correct philosophy of the approach.

In particular the philosophical-functional-structural analysis of their specific theorical disciplines' designs and studies were my guides in delineating my personal neural simulation experimental plan. It is just starting from their objective observations and result that I have obtained a series of data and informations that let me realize that we can also follow an alternative path.

Considering the present research's situation, I have essentially verified that the bionic approach cannot be only digital, or digitally started, just because nothing exists of similar or analogous in nature, and I have oriented towards the analogic one in order to obtain a similar-biologic device that could obviously be the most possible compatible with the existing in nature.

Some last years experimental researches have only partially followed this approach, anyway they try to offer possible solutions which are functional to underline the foundations of my job.

Let's start, e.g. from Berger T.W., et all (2001) who give emphasis not only on the digital but also on the necessity of an analogic approach (or at least partially analogic), in fact they say*"... it must be truly biomimetic, i.e. the neuron models (incorporated in the prosthetic) must have properties of real biological neurons ....Given the know signalling characteristics of neurons, such an implementation will most likely involve hybrid <u>analogic/digital</u> device designs ... the resulting microchip or multichip module must communicate with the existing".*

But what's is important is that the final outcome of this Authors' research showed me that the Hopfield model, they use, is efficient above all in the digital part (and gives optimal result in this field) but that it needs modifications and adaptations for a more perfect chip with more pertinent biological characteristics (and therefore exclusively analogic or similar-analogic) which can communicate with the physical part.

That's why this paper verifies one of my primary efforts, i.e. working on the existing just not to modify it but in order to adapt it to my researches' needs and objectives that fundamentally consist in the equal communicative exchange *without any external software inclusion.*

Berger et all. have exploited above all the digital part developing "*a dynamic learning algorithm (DLA) to train each dynamic synapse to perform an optimized transformation function such that the neural network can achieve highly complex tasks".*

Moving the accent more on the digital than on the biological-analogical part they had difficulties in succeeding to obtain the correct adaptive weights combination on the synapses. In fact, they say:

"... One of the key obstacles will be maintaining close contact between the electrode sites of the interface device and the target neurons over time, ...".

What they effectively obtained is an hardware that needs a software to work. Actually a true (neural) - bionic chip should be able to create its own software, and it is in this difficult direction that my researches moved.

It becomes clear that one of the main problems is concerning the interconnecting signals and in Jenker M. et all (2001) experimental works we see them highly focused on the optimal voltages' research and their optimization on the field. In fact in their chip: "*the record of intracellular voltage shows the primary response to stimulation and the resulting acting potential (centre). The transistor records the change of extracellular voltage due to the stimulus and due to the action potentials ... The extracellular voltage in junction was observed with the transistor. The upward and downward stroke of the stimulation pulses causes short positive and negative transients in e*xtracellular *voltage of the junction, as well as, in the intracellular voltage ... The action potential was recordered by the transistors a positive peak of extracellular voltage in the rising phase of the intracellular voltage, with a shoulder machine the later stages of the action potential. The first component indicate a depletion of sodium channels in the attached membrane...the later response may be attributed to an enhanced conductance of the potassium channels ... The efficiency of the electrical synapse was determined by the transfer of hyperpolarizing signals…"*

This convinced me to more and more analyse and study in depth the brain electrical sequences: *"... that will answer interesting questions about the neurobiology of neuronal works and their computational implications"* (Jenker et all -2001).

They also get on saying that it is "*the problems that must be solved before we can assemble neurochips",* and this starting from considering that first of all: *"... the strength of neuroelectronic coupling is weak. The waveforms of transistors records vary in shape and the nature of capacitive simulation is unclear. Reliable stimulation and recording of a network requires more reproducible functions"* (Jenker et all -2001).

It becomes quite obvious that a preliminary and accurate research on the powers at stake, on the correspondences among signals and quantization and on the attainable and really usable frequencies, must be absolutely essential for proceeding in a correct way.

If we analyze Eckmiller's research (1993), in his digital/analogic neural model structure we notice that: *"... the typical functional properties of a single BPN Neuron can be briefly described as follows: incoming rectangular voltage pulses of 1 ms duration and 5v amplitude reaching a synapse S, pass through a delay line T (representing the summed delays of a pulse signal in synapse, axon and dendrite), before being weighted."*.

But the specific square wave they use (so functional in other digital structures) in this case is not completely suitable because it is not completely biologically simulative. Arriving on the digital it is refined not preserving, therefore, the whole information but only the one allowed from the timing and the kind of filter used.

In my chip model I have tried to prevent this disadvantage using currents that are extra-currents of closing and/or opening of the switches and concur to the regularity of the circuitation in the pump meshes. They are also variable wave forms which are adaptive, as form, intensity and frequency, to the kind of the received wave. Therefore they are more biocompatible.

The switches used don't depend from any chip but they receive the order directly from the "pre" neuron signal, and therefore from its frequency, amplitude and intensity. The consequent answer, (either as feedback on the "pre" or as output on the "post" neuron) is totally automatic and at the same time goes to increase the augmentative memory connected to the switches themselves.

This is one of the choices that has revealed much more functional because it has allowed me to formulate my theory, simulate a completely independent hardware and create a spin off prototype device (a similar-analogic cryptor-decryptor), that's the result of its experimental application

As I clearly point out, the only possible path is the global "analogic" (or the similar-analogic) approach to the problem of the nervous system's biologic simulation. All my, purely engineering research (also theoretical and theorical), has been founded on the artificial simulation of harmonic continuous

(consonant or dissonant) communicative signals, obviously equipped, with upper harmonics which interconnect not only the single elements but also their around, and this without pre-programming anything, but acting in such a way that the Hardware self-generates its own software, self-adapting in a specific and autonomous way to the environment in which it works.
Just to validate my research's choices I want to cite Saygin A.P. et all (2011): *"Using functional magnetic resonance imaging (fMRI) repetition suppression, we explored the selectivity of the human action perception system (APS), which consists of temporal, parietal and frontal areas, for the appearance and/or motion of the perceived agent. Participants watched body movements of a human (biological appearance and movement), a robot (mechanical appearance and movement) or an android (biological appearance, mechanical movement). With the exception of extrastriate body area, which showed more suppression for human like appearance, the APS was not selective for appearance or motion "per se". Instead, distinctive responses were found to the mismatch between appearance and motion: whereas suppression effects for the human and robot were similar to each other, they were stronger for the android, notably in bilateral anterior intraparietal sulcus, a key node in the APS. These results could reflect increased prediction error as the brain negotiates an agent that appears human, but does not move biologically, and help explain the 'uncanny valley' phenomenon".* [For *'uncanny valley',* see in References, Mori M.]*"*.

3.2 The Author's Research Path

If "*in the language only differences do exist*" (Saussure, 1916), if "*the meaning of the word is its use in the language*" (Wittgenstein, 1953), if "*the meaning of an assertion is its method of evaluation*" (logical new-positivism), and if "*a mathematical object is what it does*" *(T. Gowers, 2002)*, than the serially (diachronically) and parallely (synchronously) interconnected physical devices, simulated in my research, evidence their differences through the functions to which they give life inside the originating structure. In this way they are all absorbable in the mathematical language that gives a perfect simulation.
I think that the distribution of a neuron's specific structure follows an accurate reasoning of functionalities and that the (dissipative) system, that they create, follows ordered rules, easy comparable to those of an operator field.
I am moreover convinced that a mathematical simulation of the neural system space-time distribution shows its non commutativity and that we can obtain that a (determinable) logic exists in the distribution of the different clusters of neurons.
Obviously with specific parameters to determine which depend mainly from my new model of neural communication, a new model of transmission founded on (analogic) capacitive stimulation (and more other) and on contact.
If the specific system demonstrated itself commutative, then it is simpler to establish operating parameters of neural associativity.

My research phases are evidenced in Figures 01 ÷ 05 sequence. With these Figures I can briefly summarize my whole research path that will be described in detail.

1. In Figure 01: the hypothesis of the neural segmentation; of the frequencies set choice; of the sax-neural coupling analogy.
2. In Figure 02: the Cubic Matrix algebra [for 0 (only one element)-1-2-3 dimensions]; the "De Morgan Pus" Theorem (for circuits simplifications); the Plasma-Jet flux Cone.
3. In Figure 03: the elementary circuit; the structural-functional neural analogy.
4. In Figure 04: the Axon-Linear Accelerator analogy (non-relativistic case).
5. In Figure 05: the Brain-Ellipsoid of rotation analogy
6. In Figure 06: the First Theoric Model (1993).

Moreover in Figure B (note 2) there is a brief description of the prototype of a similar-analogic cryptor-decryptor that is a spin off of the simulated Prototype 7.
These authoritative Scholars and Researchers (in alphabetical order) have specifically dealt with the scientific topics I have studied for my work:

- Atkins P.W., 1994.
- Atkins P.W., Freidman R.S., 1997.
- Bird R.B., Stewars W.E., Lightfoot E.N., 1960.
- Denbigh K., 1977.
- Goddard W. A. III, Brenner D. W., Lyshevski S. E., Iafrate G. J., 2003.
- Grattarola-Massobriom, 1998.
- Kandel E.R., Schwartz J.H., Jessell T.M., 1991.
- Lajtha A., 2007, 2009.
- Nelson D.L., Cox M. M., 2008.
- Oja S. S., Saransaari P., Schousboe A., 2007.
- Rao M.S., Jacobson M., 2005.
- Smith C. U. M., 2002.
- Südhof T.C., Starke K. (Editors), 2008.
- Teodorescu H-N, Kandel A., Jaln L.G, 1999.
- Vizi E. S. (Editor), 2008.

3.3 Author's Works

I here describe the simulation of a model of a circuit that emulates the Na-K (Sodium-Potassium) pump. It derives from a new model of neural transmission which is based on the essential difference between tele-communication and bio-communication: i.e. tele-communication is rigid and aseptic and bio-communication has also [bio]inertia (we have to think to a pill's absorption and metabolizing time and the consequent body reaction) either in transmission and in reception.
I consider also the hypothesis that whatever neuron behaves in analogous and not identical way in reception and, in transmission; it is subdivided into decomposable more and more specialized portions and, moreover, and it transmits and receives with lags only on iso-frequency trajectories, in *cones* of flux or fluid, which have the characteristics of an ionized gas. I also believe that in any bionic synapse, messengers *in* and *from* any possible direction can be transmitted and received and also that a specific kind of messenger is accepted by only one particular kind of receptor, or forwarded only by a particular kind of transmitter. Specifically, the receptor will have to utilize the same frequency of the transmitter.
To emulate this structure, I am convinced that:

7. lags are done by inductance;
8. switches give transient conditions and produce opening and closing extra-current, creating or interrupting the electric flux either in the mash simulating the **Na-K** pump and in the branch simulating the **Cl** (Chlorine) one;
9. charge and discharge condensers (in the Cl branch) determine the threshold signals;
10. only analogic signals have to be compounded and modulated, to create a steeples caring wave.

It is functional to use a switched input oscillator, that here becomes the cybernetic equivalent of the tout court logic, but changing it from an a-temporal to a temporal logic. It can so effect the transition between objects (in this case: neurotransmitters) and connections, constructing, for example, the directions for the interconnections among elements which become interdependent.
I have considered coherent the possibility to simulate at least three types of circuit elements that, taken together as a systemic set, can give us **36** possibilities (some are repeated) for the construction of **27** different Na-K pumps. Each of these **27** different combinations of electronic base components can be

considered as an ATPase mechanism simulation.

The final base-structure, simulated, projected, and partially realized in the year 2002 (from **80** to **960** cards in **27** different configurations, with different combinations, in double 7-values logic and everyone of them subdivided into **40** strata), if only partially active - with a field of imposed suitable frequencies (with ad-hoc analogic and non-digital devices that aren't here described) conveniently combined and permutated among them- in its whole, can give at least over $\mathbf{10^{45}}_{\text{(minimum)}}$ interconnections, at various frequencies and wave-forms.

All these interconnections, modulated, half in Aristotelian logic, half in fuzzy logic, simulate the left and right lobes of the brain.

For one single complete element of this structure, I have obtained the theoretic simulation of at least over $\mathbf{10^{52}}_{\text{(minimum)}}$ messengers, with **m**olecular **w**eight **u**nits (**m.w.u.**) between $\mathbf{10^2}$ and $\mathbf{10^3}$, which give al least over $\mathbf{10^{57}}_{\text{(minimum)}}$ informative signals.

For the structure I make use of three values logic that, for an eventual further formation of tissues (see Figures 29÷34) of bionic elements, will increase al least to seven. This seems to be an ideal situation for a correct planning, because, if it is impossible to create biologic messengers, they can anyhow be replaced by their energy forms, transmitted or received through microprobes.

Moreover, considering the automatic energy transfer, I can deduce that it is possible to by-pass, exalt or eliminate the activation or inhibitory mechanisms, such as the monoamine oxidase (MAO).

I have so realized an emulator system as a quasi-Boolean net, but functional only, because the omni-directional reaction to an operative -at a perturbation level action- gives origin to different functionalities in a similar structure, which exists in a non-digital way, or, it might be better to say, which lives in an analogical quasi-digital way, with molecular code and decode factors, to which, at present, I approximate in a not quite complete way.

Basing on theorical calculus, each oscillator, in series of stratums, originates energy and frequency forms for the neurotransmitter simulation.

So we obtain: for each neurotransmitter a quantum cloud equal to $\mathbf{3x10^5}$ quanta, i.e. an informative unit cloud equal to $\mathbf{1{,}5x10^5}$; to each **m.w.u**. $\mathbf{10^2}$ messenger, an association of at least **3** virtual masses, identical among them and to the real mass; and to each **m.w.u.** $\mathbf{10^3}$ messenger, an association of at least **30** virtual masses, identical among them and to the real mass.

All this happens either in reception or in transmission distances to the maximum of **500** times the Böhr ray, in closeness of length to a Debye wave, and with frequencies up to a thousand times smaller than the Larmor electronic frequency.

I simulated a series of prototypes, and in all the previous models as well as in this one, which is the 12^{th}, *[the followings (now the simulated prototypes are 21, with 36 releases) are more and more specialized spin-off also in other cybernetic sectors)]*, the essential work is in accordance with these assumptions:

- we have the configuration of balance for the Na-K pump;
- we can insert in it switches and replace the generic resistances with appropriate resistors, which run in fixed frequency-fields;
- opening and closing the circuits, we can create the conditions of dis-equilibrium, that give different productions of currents, which, each in turn, generates various signals in transmission.

The various signals must then be put together, placed, enlarged and transmitted.

Stated what's above, I can describe this very **simplified** prototype model which consists of a single sub-stratum among **80** (40+40) sub-strata, that at its turn becomes a single element of an hexagonal group, and this single element has **5** signals instead of **27**.

I have obtained an almost perfect correlation between the signals that are generated in nature and those that I have artificially produced. Analyzing the data, I have noticed that equal signals obtained among

the signals generated in nature and those that I have artificially produced can be compared, either for values and for development, to the pre and post-synaptic ones (from **-65**mV, **-75**mV to **+55**mV volt agent, and inferior to **2**pA currents). In fact, the presented bionic simulated structure proves to be analogous to a set of staminal cells, and moreover, with the opportune modifications of the resistance elements, it is even analogous to a set of glial cells.
Moreover I can demonstrate that, at present, I am able to:

- build signals similar to physiological ones;
- have a bionic dialogue;
- build "3D" structures, ever more and more complicated.

I can also demonstrate that, in order to build a real and working artificial intelligence, or a specific or a particular part of it, I have preliminarily to plan an "opposite-engineering" system that, starting from the biological (and not "vice/versa"), can contemporarily define the "how", hoping it becomes also the "why". So if we want to insert communicative-informative probes (in receiving and in transmission) which can work, for now, in relatively small spaces and, also, in the inter-synaptic spaces, we just have a suitable system (math-inf-electr) emulating the cerebral structure or a cerebral under-structure, or simply a neural or a cellular structure.

4. WORK'S HYPOTHESES AND CONDITIONS

The fundamental ideas that lead to this new electro-informatics model construction [(2)] are:

A) From the point of view of the structure construction:

1. the artificial neural structure is composed by interconnected modular parts;
2. the neural system can be represented by a composite graph in which the *paths* are constituted by neurons and the *nodes* are constituted by the contact synaptic points among the same neurons, or by atrocities (as intermediate);
    - The graph will have as many arcs as the reticule elements (atoms).
    - The $p_1,...,p_n$ arcs will form a circuit (that will be defined dependent) if, and only if, the $p_1,...,p_n$ atoms in the reticule will be covered by the same element;
    - The trees which are extractible from the graph corresponding to the tridimensional reticule L, will have all the x_{ji} side if, in the geometry corresponding to L, whatever points base, which generate it, will contain x_{ji}
    - The trees, extractible from the graph, correspond to the matroid bases: a tree will have the arcs $x_{1(ij)},...,x_{p(ij)}$ if $x_{1(ij)},...,x_{p(ij)}$ were one of the sub-sets of the graph arcs that result to be chiefly independent.
3. the algebraic structures associated to the neural sub-sets are Non-Abelian Groups.
4. each interconnected modular part is composed of clusters of oscillators with variable resistance, inductance and capacities characteristics, settled among them in under-sets, ordered with permutation, disposition, and combination criteria;
5. each interconnected modular part is formed by a variable number of sets of plates of which there is just one with central link characteristics and at least another one working in non-Aristotelian logic and/or at least another one working in Aristotelian logic;
6. every plate is composed of an optimized number of oscillators (with appendages) which transmit with several different wave forms;
7. each oscillator works in a field of intensity current, potential difference, wave form (sin., triang., squa.), frequency (with an approximation to the third decimal), intensity and signal typology (continuous or discontinuous), in a receiving conditions dependent way;
8. each oscillator behaves as an autonomous component of a neural simulation net that is assumed as a dynamic interface either towards a natural neuron or a single set, and/or several natural neuron sets, and establishes reciprocity and reversibility relationships in resonance;
9. each working at a quantic level oscillator transmits informative bits in function of the quanta' numbers (the informative energy of **1 bit** *is equivalent to energy* of **2 quanta**). The natural neurotransmitters are artificially replaced by the associated generic energetic forms. As in the natural model, in the artificial one the through a nutation chaotic cone information transfer is selectively absorbed by the receptors which have the same frequency of the various under-stratums transmitters: the transferring and the receiving take place in iso-frequency; that is it exists just an only receiving point towards which the neurotransmitter, issued by the transmitter, will be directed;
10. any neuron acts, in its completeness, *simultaneously* interpreting both the cerebral lobes influences;
11. the bottom noise determines the inertia to the answer and masks the synchronicity. Every oscillators' combination or permutation or disposition issues, are disguised as radiation, information in iso-frequency: the emission takes place in a similar-digital form on an analogical carrying wave;
12. for every plate the feed-back is studied and simulated also by a virtual *"Petri's Nets"* and the

serial and the parallel ones are simulated also by a virtual *"Markov's Chain"*; we know that we are dealing with exclusively analogical signals which respect their being digital only for the fact that they are present or absent. In order to respect this pseudo-digitalism, the switches are plugged inside the artificial circuits, give the emission cadence restoring or changing the immediately preceding conditions: in such a way they contribute to the formation of several serial and/or parallel kinds of feed-backs, emphasizing or decreasing the number of virtual "Petri's Nets" and of virtual "Markov's chains", which have origin: and this happens with repeatable logical sequences;

13. for each plate the oscillators set is structured in a Na-K pump (and Cl) simulation;
14. the natural neurotransmitters are artificially replaced by the associated generic energy forms.

B) From the theoretical point of view (that is the basis for my researches which describe the production and the direction bus of the informative signals):

1. the new transmission neural model characteristics are:
    - the time and the neural activity are non-continuous;
    - the set of **2n** neurons is subdivided into two subsets: **n** transmission (**j** neuron), **n** reception (**m** neuron). Both neurons subsets are connected among them by unidirectional reticule connections;
    - to each neuron a variable $\sigma_j = +1$ is assigned if the neuron (of subset **j**) is active (in transmission) and $\varepsilon_m = +1$ if the neuron (of the subset **m**) is active (in reception). To each neuron a variable $\sigma_j = -1$ is assigned if the neuron (of subset **j**) is passive and $\varepsilon_m = -1$ if the neuron (of subset **m**) is passive (in reception);
    - the reception frequency is determined by induction from the transmission frequency;

      <u>*observation 1:*</u> these assumptions introduce a new systemic neural transmission model from which we can assume that the neurons (even if they structurally and functionally look like the same among them), *if considered isolated*, at the very moment of their inter-relations, assume diversified characteristics in function of their intrinsic structures. In particular the neurotransmitter transit, from a point to another of the inter-synaptic space, must follow determinate quantum laws which involve the isofrequency both in the trajectory and in the initial points and conclusions of the trajectory itself. There is, in other words, the presence of the *"Feynman path integrals*" conditions, associated to particular "extremes" of the path itself; this gives origin to a succession of times which apparently does not explicitly provide the contemporaneity;

      <u>*observation 2:*</u> we know that the stability properties of the open systems, which are far from equilibrium (and in the neural rice-transmission we are involved in this situation), can be formulated in terms of thermodynamics quantities, which present themselves as state functions. On the basis of what I say in the previous note, an integrating factor, such as turning the *"Feynman path integrals*" into a state function, will have to exist, just to respect the minimum production entropy theorem;
2. in the trajectories in iso-frequency, the absence of the neurotransmitter is equivalent to the inhibition;
3. the neurotransmitters, and in general the messengers flow, is equivalent (in physics-mathematics simulation) to plasma-jet flow cone;
4. in the neurotransmitters and messengers study, it is valid a non-classical statistical distribution function, obtained by the combination of the Fermi-Dirac function with the Bose-Einstein's one;
5. two synaptic systems connected with the neurotransmitters (or with generic messengers)

exchange information that we can represent through undulatory representations which are antecedent the arrival of the masses transmitted with quantized value on the wave lengths;

6. a non-Aristotelian new logic is obtained applying the “de Morgan Theorem” with the exclusion of the combinations "all zero " and "all one": the *“Plus” De Morgan Theorem*;
7. the Lie’s algebra is functionally able to represent the synaptic micro-cosmos;
8. the Cubic Matrixes algebra can solve the holomorphic "minimum distance" function obtained with the Lie’s Algebra;
9. the Cubic Matrixes algebra does not admit the “transposed” and therefore, considering the neurotransmitters in their hole, it gives us their behavioural indeterminateness: from this the “certainty” of the presence of uncertainty, the creation of fluctuation points among what is memorized in augmentative memories and all the intrinsic possibilities of the subsequent dynamic process;
10. the symmetry (considered by my model a sum of antimetries) generates the informative flux and the artificial life is represented as the emulation of the natural autopoiesis;
11. for artificial autopoiesis:
    - the interconnection, i.e. the mutual (sometimes univocal and sometimes biunique) relation among elements and/or among the systems, and/or among structures or functions, works among nests and chains generating closed micro-systems in the opened total system that’s the organism. Also in the micro-systems that work with feed-back, the different feed-backs are at their turn connected among them;
    - the non-linearity assumes the non-presence of linear -at finished dimensions- vectorial spaces generating a linearly proportional algebra. In the asymmetric (antimetric) and dissipative chaotic systems, the -a different degree- PDE include also transcendent functions (ln, sin, cos, tag, exp, etc.).

5. TECHNICAL SYSTEM DESCRIPTIONS

Field of application

The present simulation refers to an artificial and/or bionic neural structure formed by modular electronic elements for generating and/or re-establishing a correct communication among components of a biological structure, in particular a nervous system.

More specifically, the simulation refers to a structure of the aforementioned type. It includes a central section responsible for the generation of electrical signals, as well as a first and a second end section connected to this central section and to the respective input and output terminals located on opposite sides, with respect to a point of interruption of the communication.

In particular, but not exclusively, besides the nervous systems, the simulation concerns also a system for producing electrical signals (that can be used in the field of bionics in human and animal nervous systems that have suffered damage to the mechanisms for transmitting information after illness and/or traumatic events).

Prior art (see Figures 1-2)

As it is well known, the transmission of stimulus inside the human or animal nervous system is carried out by neurotransmitters which are molecules capable of transmitting information signals to the cellular synapses according to an electro-chemical mechanism.

In particular, it has already been demonstrated that the performance of the animal nervous system is based upon the well known Na-K physiologic pump that works with energy values swinging between opposite equilibrium values.

Such a Na-K physiologic pump can be simulated and emulated electronically through a model schematically illustrated in Figure 1 and fully indicated with 1.

Such a model 1, that I will define as physiologic, essentially comprises three modelling branches formed from series (or parallel) RC (or RLC) circuits, connected together in parallel between a first T1 and a second terminal T2, respectively corresponding to the surface of a cytoplasm and to an extra-cellular surface.

More specifically, the serial (or parallel) RC (or RLC) circuits (R1-C1, R2-C2 and R3-C3) are used to model the equilibriums of the elements Cl, K and Na, respectively.

The voltage originating from the direct current (DC) generators C1, C2 and C3 is fixed at -**69**mV, **-75** mV and +**55**mV, respectively.

In the physiologic model 1 a common capacitor C is also foreseen, connected in parallel to the RC (or RLC) circuits between the terminals T1 and T2.

Starting from such a physiologic simulation model of the Na-K pump it is possible, introducing suitable modifications, to simulate three-dimensional coupling branches of various artificial circuits, so as to obtain, in the bionic field of application, artificial "tissues (see Figures 29÷34)" for "apparatuses" or "systems" for potentially replacing analogous biological apparatuses and systems.

A corresponding simplified model of the Na-K pump, which I define as bionic, is illustrated as an example in Figure 3 and fully indicated with 2.

Such a bionic model 2 comprises, in an analogous way to the physiologic model 1, a first T1 and a second terminal T2, respectively corresponding to the surface of a cytoplasm and to the extra-cellular surface between which a first 3, a second 4 and a third modelling branch 5 are connected.

The first modelling branch 3 comprises, in series between the terminals T1 and T2 respectively, a DC generator, a first resistor, an inverter switch and a second resistor, an intermediate point of the inverter switch being connected to the second terminal T2 through a further capacitor.

Moreover the second branch 4 comprises, in series between the terminals T1 and T2 respectively, a DC generator, a first switch, a first RL circuit, a second switch and a second RL circuit.

Finally, the third branch 5 comprises, again in series between the terminals T1 and T2 respectively, a DC generator, a first switch, a first RLC circuit, a second switch and a second RLC circuit.
The results that can be obtained with such a bionic model 2 can of course be applied (although with all the necessary modifications and implementations) to more complex circuits or more generally to the same circuit that "works" with the addition, in parallel, of successive meshes or networks, which have been ad hoc modified, to obtain, indeed, the desired couplings.
Such modelling has been studied to seek the way to re-establish the interruption in communication inside the nervous system.
A lot of studies proved that, within the nervous system, each group of cells, that are responsible for a precise task, communicates with a determined series of frequencies in order to ensure a transmission of data pertinent to a specific informative "fragment".
A possible (be it partial or total) interruption in this communication, may also be due to structural defects of a given cell or of a group of cells and can produce a lack of communication of the information in question. The group of cells involved by such a lack or interruption in communication does not therefore accomplish its natural task. We have seen that other researches have tried to re-establish specific neural communications in the case of defective operation of the cells responsible for such insufficient, partial or absent communication, or in the case of traumatic events, not completely realizing a device capable of re-establishing such a communication working as a real bionic neural device (they are all digital or essentially digital).
The technical problem at the basis of the present simulation was the conceiving of a device or of a modular electronic element which could have structural and functional characteristics such as to allow the assembling of an artificial neural structure capable of simulating a group of natural neurons in situ.

Summary of the simulation

The solution at the basis of the present simulation model is an artificial analogical neural structure assembled through a plurality of swinging circuits grouped in meshes. In particular, the simulation proposes to collect together and to process analogic and digital signals produced inside such meshes so as to provide compressed information bands.
Based upon such an hypothesis the technical problem can be solved by an artificial neural structure of the type indicated previously and defined by the characterizing part of claim 1.
According to the simulation, the characteristics and advantages of this artificial neural structure becomes well clear from the description represented in the attached drawings.

Brief description of the drawings

Figures 1 and 2 schematically show a modelling of a Na-K physiologic pump according to the *prior art*;
Figure 3 schematically shows a modelling of a Na-K bionic pump that represents the theoretical basis of the present simulation;
Figure 4 schematically shows a variant of a detail of the model of Figure 3;
Figures 5 and 6 schematically show a bionic neural structure according to the simulation in different ways of operating;
Figure 7 schematically shows a modular electronic device which is able, according to the simulation, to simulate an analogic bionic module;
Figure 8 compares two different configurations of the bionic module in Figure 7;
Figure 9 shows a bionic module made according to the simulation in greater detail;
Figure 10 schematically shows possible configurations of the bionic module made according to the simulation (*each of the 27 combinations of the electronic base components works as an ATPase mechanism simulation*);
Figures 11 and 12 schematically show organizations of modules for making a neural bionic structure

according to the simulation.

Detailed description

Referring to such Figures, and in particular to the example of Figure 3, a bionic model of a Na-K pump that forms the theoretical basis of the present simulation is totally and schematically indicated with 10.

Hereafter we will talk about a bionic model (or structure) with this term intending to refer to objects made in analogy with the biological behaviour of the human or animal nervous system.

According to such a bionic model 10 the neurotransmitters move along predetermined directions and at a constant frequency or isofrequency.

In particular, the bionic model 10 comprises, in accordance with the well known physiologic model 1 illustrated previously, a first terminal T1 and a second terminal T2, respectively corresponding to the surface of a cytoplasm and to the extra-cellular surface between which a first 11, a second 12 and a third modelling branch 13 are connected.

In particular, the first modelling branch 11 comprises, in series between the terminals T1 and T2 respectively, a DC generator, a first resistor, an inverter switch and a second resistor, an intermediate point of the inverter switch being connected to the second terminal T2 also through a capacitor.

Advantageously, according to the simulation, the first modelling branch 11 also comprises, connected between the second resistor and the second terminal T2, a capacitor circuit 14 with a complex structure and comprising a variable number of elementary capacitor structures.

Moreover, the second branch 12 comprises, in series between the terminals T1 and T2 respectively, a DC generator, a switch and an RL circuit.

Advantageously, according to the simulation, the second modelling branch 12 also comprises, connected between the RL circuit and the second terminal T2, a first complex swinging circuit 15 at its turn comprising a variable number of elementary swinging circuits formed from switches and RL circuits.

Finally, the third branch 13 comprises, again in series between the terminals T1 and T2 respectively, a DC generator, a switch and an RLC circuit.

Advantageously, according to the simulation, the third modelling branch 13 also comprises, connected between the RLC circuit and the second terminal T2, a second complex swinging circuit 16 in its turn comprising a variable number of elementary swinging circuits formed from switches and RLC circuits.

The elementary swinging circuits can be series circuits, as illustrated as an example in Figure 3, but, in a totally equivalent way, they can be parallel circuits or mixed series-parallel circuits.

Moreover, it should be noted that the complex swinging circuits 15 and 16 substantially comprise elementary components such as resistors, inductors and capacitors, organized in meshes or networks, such meshes being able to be increased in number as illustrated in Figure 4.

To simplify the presentation, hereafter reference will be made to a base double mesh, as illustrated in Figure 3; the considerations and the results obtained nevertheless being able to be easily translated to all possible more complex derived schemes.

Starting from known equilibrium values of the Na-K pump, the bionic model 10, according to the simulation, allows an artificial or bionic neural structure to be obtained. In particular, the proposed bionic neural structure is made to work in a substantially forced way, artificially causing its disequilibrium.

For this purpose, in the bionic neural structure of the present simulation, additional switches are inserted and the generic resistances are replaced with special resistors, working in variable frequency fields in predetermined ranges, as it will become clear in the rest of the description.

In such a way, by interrupting the operation of such elements with particular frequencies, conditions of disequilibrium can be created, consequently obtaining the generation of different current values that in turn cause various emissions of signals in transmission with various frequencies and various

waveforms.
Advantageously, according to the simulation, the proposed bionic neural structure comprises a plurality of modular cards, connected together, suitable for producing analogic electrical information signals with various waveforms and various electrical powers.
In particular, to be able to simulate a neural communication, such a bionic neural structure works with frequencies operating in the field of radio waves and in the field of light waves. Moreover, the electrical powers, used for the generation and the subsequent treatment of signals, are bio-compatible or computer-compatible, according to the following ways:

1. for frequencies operating in the field of radio waves, the powers are bio-compatible;
2. for frequencies operating in the field of light waves, the powers are computer-compatible.

A bionic neural structure 20 comprises a central section 21 responsible for the generation of signals for transmission, as well as a first 22A and a second end section 22B connected to the central section 21 and to a respective input terminal IN and output terminal OUT of the bionic neural structure 20.
In particular, the first end section 22A is suitable for collecting control signals received on the input terminal IN and for sending them to the central station, whereas the second end section 22B is suitable for routing and amplifying the signals for the transmission coming from the central section 21 towards the output terminal OUT.
The bionic neural structure 20, according to the simulation, allows the connection between a first 23A and a second group of biological neurons 23B, in particular at a first and a second intersynaptic space 24A and 24B, respectively.
Advantageously, according to the simulation, the bionic neural structure 20 is also equipped with an input interface 25A, connected between the first intersynaptic space 24A and the input terminal IN, and with an output interface 25B, connected between the output terminal OUT and the second intersynaptic space 24B.
In particular, the input interface 25A comprises a set of contact probes suitable for receiving suitable neuro-electric signals from the first intersynaptic space 24A and connected to control and feedback elements.
In the same way, the output interface 25B comprises a set of contact probes suitable for transmitting suitable neuro-electric signals to the second intersynaptic space 24B and connected to control and feedback the elements.
In such a case, the connection probes, in reception and in transmission, contained in the input and output interfaces 25A and 25B respectively, are similar and/or analogous to those now conventionally used for brain stereotaxic neuro-surgery.
In a totally equivalent way, it is possible to use the bionic neural structure 20, according to the simulation, for the connection to a first and second group of integrated circuits 26A and 26B respectively, replacing the contact probes inside the input and output interfaces with suitable connection terminals, as schematically illustrated in Figure 6.
In such a case, the connection terminals, in reception and in transmission, contained in the input and output interfaces 25A and 25B respectively, are similar and/or analogous to the usual ones between wired circuits and/or integrated circuits.
The proposed bionic neural structure 20 is, indeed, able to work in at least two ways of operating and therefore in at least two separate fields of application:

1. according to a first working way (illustrated in Figure 5), conveying out an informative connection from the outside of an organism towards its inside or else inside the organism itself;
2. according to a second working way (illustrated in Figure 6), conveying out an informative connection from the outside of a data processing machine towards its inside or else inside the data processing machine itself.

It is also possible to consider a third way of operating with the two mixed operative ways (here not

shown) in which an organism and a data processing machine work in special conditions of interconnection.
Therefore, the bionic neural structure 20, according to the simulation, operates receiving and transmitting analogic signals, which, by their nature, provide all possible information and are the only one that are bio-compatible, avoiding transductions and/or conversions.
To do this, the bionic neural structure 20 comprises a plurality of elementary components, or bionic modules, based upon the bionic model 10 of the Na-K pump illustrated in Figure 3.
In particular, each module 30, as schematically indicated in Figure 7, comprises a first, a second and a third circuit branch (31, 32 and 33 respectively) corresponding to the modelling branches illustrated with reference to the bionic module 10, the number ***h*** of which can vary (with ***h > 3***).
Studying such a module 30 I found that it is able to generate five types of signals S1-S5 at internal circuit nodes.
Specifically, the first circuit branch 31 has a first and a second internal circuit node, X_{11} and X_{21} respectively, at the ends of a capacitor included in it. In the same way, the second circuit branch 32 has a first and a second internal circuit node X_{21} and X_{22} respectively, at the ends of a first RL circuit included in it and a third and a fourth internal circuit node X_{23} and X_{24} respectively, at the ends of a second RL circuit included in it. Finally, the third circuit branch 33 has a first and a second internal circuit node X_{31} and X_{32} respectively, at the ends of a first RLC circuit included in it and a third and a fourth internal circuit node X_{33} and X_{34} respectively, at the ends of a second RLC circuit included in it.
In simulating the operation of the module 30, I thus noted that the simple signals (S_1, S_2, S_3, S_4, S_5) were similar or analogous to the intra-cellular ones, whereas the composite ones (S_1-S_3, S_2-S_3, S_4-S_3, S_5-S_3) were similar or analogous to the extra-cellular ones.
In particular, the similarity or analogy relative to the following properties was noted:
1. current intensities (here not shown);
2. differences in potential (here not shown);
3. frequencies (here not shown);
4. waveforms (here not shown).

Moreover, corresponding counter-signals were obtained by simply inverting the power outputs of the circuit branches 31-33, as schematically illustrated in Figure 8 where a module 30A suitable for making a Na-K pump and a module 30B suitable for making a Na-K inverse pump are compared.
Advantageously, according to the simulation, using different frequencies for the switch included in the module 30 and different amperage values, I have obtained correct operation also on the highest harmonics.
In such a way, it is also possible to activate various information flows inside the module 30 in an also synchronous way with possible peripheral receivers and not just acting on a single effective receiver.
To do this, the module 30 is suitably connected to a logic processing structure 31 which comprises a plurality of logic gates suitable for receiving signals S_1-S_5 inside the module 30 in an alternating way, so that to provide information bands on a plurality of output OUT terminals, as schematically illustrated in Figure 9.
The plurality of logic gates inside the logic processing structure 31, similar or analogous to digital NOT, AND, OR gates, is organized in groups, according to known configurations in series and/or in parallel.
In particular, each initial signal S_1-S_5 produced inside the module 30 (analogic electric information signal) is treated by the groups of logic gates to obtain elementary information bands (again analogic electric information signals) responding to the conditions dictated by a conventional logic (of the binary 0-1 type) and/or by “Fuzzy” logic, to be recomposed then in the output information bands.
Each module 30 can comprise twenty-seven configurations that can also coexist, as schematically illustrated in Figure10, given by the combinations of the base distribution; in particular, these

theoretically correspond to twenty-seven biochemical mechanisms that are similar or analogous, causing, in simulation, the analogic of twenty-seven resonance hybrids.
Advantageously, according to the simulation, the modules 30 thus conceived in their different configurations, are organized into groups 40, each comprising up to ***n*** modules, as schematically illustrated in Figure11 with ***n = 12***.
Moreover, each group, or an assembling of ***m*** groups, makes a modular card 50 according to the simulation, as schematically illustrated in Figure 11 with ***m = 12.***
According to the simulation, each modular card 50 is organized into:

1. sub-sub-assembling for example of eight cards (one of which in conventional logic and seven in fuzzy logic) to constitute a first sub-assembling 50A of **64** cards;
2. sub-sub-assembling for example of eight cards (one of which in fuzzy logic and seven in conventional logic) to constitute a second sub-assembling 50B of **64** cards.

In this case, the two sub-assembling constitute an overall assembling able to generating the signals required for the bionic neural structure 20; in the illustrated example I simulated **128** cards that make a base assembling (see point 60) as schematically illustrated in Figure 12.
Each new band of information signals is divided into various bands of sub-signals with suitable retro-actuated phasing, which, in turn, are distributed, for example, among the modular cards, with the mathematical criteria of the Setting, Combination, Dispositions and Permutation operations, obtaining composite bands.
Each composite band can, in turn, be amplified (using different groups of circuits with two or more meshes, similar to the previous ones and replaced in their functions by modules or blocks, for example of the AGC and/or PGA type) and subsequently prepared for the transmission with final controls activated using further groups of circuits with two or more meshes, also similar to the previous ones and replaced in their functions by modules or blocks, for example of the AGC and/or PGA type, thus obtaining the definitive signals.
Each definitive signal, ready for analogic transmission, can also be subjected to Analogic/Digital converters to obtain possible immediate computerized controls.
The signals transmitted (just like those received) are also retro-actuated up to the switches of the individual branches of the individual meshes of the individual electrical schemes, to carry out both new ways of producing the initial signals (waveform, wavelength, electrical power), and the formation of growing memories (for example of the E2 type) that are also subjected to possible computerized controls.
The switches contained in the modules 30 are also able (using suitable frequency adapters, waveform adapters, etc.) to receive signals from other transmission sources, signals that in turn regulate the production of the signals to be transmitted both in waveform, in wavelength and in electrical power.
Referring to the ways of operating of the bionic neural structure 20, illustrated previously, at this point it is useful to specify the operation of the first and of the second end section 22A, 22B of the bionic neural structure 20 according to the simulation.
In particular, according to the first way, the analogic signals, that are moving *towards*, are directed to the frequency and waveform converters of the swings of the elementary circuits included in the bionic neural structure 20, which provides comparing them with the memories of the generation circuits themselves. In the same way, the analogic signals in output are sent to the double probes, one of which is in feedback for comparing them with the memories of the generation circuits.
Moreover, according to the second way, the digital signals, that are moving *towards*, are firstly subjected to Digital/Analogic converters and then directed to the frequency and waveform converters of the swings of the circuits, which provides comparing them with the memories of the generation circuits.
In the same way, the analogic signals in output are firstly subjected to Digital/Analogic converters and

then sent to the double connections, one of which is in feedback for comparing them, after the obvious Digital/Analogic conversion, with the memories of the generation circuits.
In conclusion, the bionic neural structure 20 becomes an instrument operating exclusively with (direct or indirect) analogic inputs and outputs, whilst still being totally compatible with possible digital commands to be made.
It should be clear that the proposed bionic neural structure 20 has numerous applications according to the ways of operating indicated and illustrated above.
In particular, according to the first way of operating, the bionic neural structure 20 makes possible to make:

- bionic components of animal and vegetable organisms;
- the simulations and/or the counter-simulations (for therapeutic purposes) of any type of cellular signal through generation of the same energy contents of the cells considered;
- by-pass components for applications in cases of Tetraplegias, paresis, or similar, deriving from external causes, i.e. from ictus, from aneurisms and/or similar;
- components for partial or total replacement of cerebral nerve pairs or of nerve channels of the dorsal vertebrae;
- intervention components on sensor-motor situations for any type of neuropathy, for example in cases of Alzheimer’s or Parkinson’s disease, in the case of sclerosis, epilepsy, senile dementia, impotence, frigidity, as well as in the case of degeneration of the tissues (see Figures 29÷34) for causes, which may also be external, acting on the nervous system;
- generic or specific intervention components for the central or the peripheral (voluntary or involuntary, total or partial) nervous system intervention components on brain sectors, for any type of dysfunction, like in the case of dysphemia, neurosis, psychosis, anorexia, bulimia, anxiety, stress, depression, obesity, total or partial loss of memory, of sleep, etc.;
- intervention components on bacterial or viral pathologies;
- intervention components for various symptomatologies like, for example, neuralgias, mialgias, arthrosis, etc.;
- intervention components for neoplastic cells, on the lymphatic system, on the enzymatic system, on the immune system and on the hormonal system;
- intervention components for biological apparatuses and tissues (see Figures 29÷32);
- simulations of macromolecular behaviour in biological systems and/or apparatuses;
- direct and, above all, inverse, protein simulations for applications in the study of AIDS, AIF, Prions, etc;
- simulations of biological mechanisms like, for example, those of ATP, MAO, etc.;
- functional replacement devices of neuro-transmitters or protides in general through simulation of their relative energy contents;
- functional replacement devices of groups of artificial cells (staminal, glial, etc.) through simulation of the relative energy contents.

In the same way, according to the second way of operating, the bionic neural structure 20 makes possible to make:

1. parts or the totality of a super-computer network, acting at the speed of light and, each one, with the complexity of a human brain;
2. parts or the totality of a signal receiving and transmitting network, acting at the speed of light and with the complexity of a human brain.

Finally, according to the third way of operating, the bionic neural structure 20 makes possible to make, for example, an interconnection system between the biological and the artificial, for tele-monitoring and/or sanitary tele-tests and/or other.

Advantageously, the proposed bionic neural structure 20 has a structural configuration such as to be able to be transformed, e.g. using the methods of nanotechnology, into structures, for example fullerenic and/or of nano-tubes and/or other.
In such a way, using the bionic neural structure 20 according to the simulation and a series of multi-layer analogic circuits it is possible to make a biomedical device and a super calculator parallel with the complexity of the brain.
It should also be cleared that the proposed bionic neural structure 20 is not only self-organising, but continually refers to itself, basically behaving like an autopoietic system, i.e. based upon the processes and upon their mutual relations and on the feedback among them.
The hardware structure of the bionic neural structure 20 does not require any software programme, carrying out by itself an operating programme in a virtual, autonomous, dynamic and automatic way.
Advantageously, according to the simulation, the proposed bionic neural structure 20 transmits and processes analogic signals, in other words bio-compatible signals.

6. MAIN TECHNICAL SIMULATIONS

1. an artificial or a bionic neural structure (20) formed by modular electronic elements for generating and/or re-establishing correct communication among components of a biological structure. It is made by a central section (21) responsible for the generation of electrical signals, as well as a first and a second end section (22A, 22B) respectively connected to the central section (21) and to respective input and output terminals (IN, OUT) respectively located on opposite sides with respect to a point of interruption of the communication, characterized in that it comprises a plurality of modular electronic devices (30) interconnected together to form at least one pair of meshes and capable of generating analogic electrical signals of various waveforms and various electric powers;
2. an artificial neural structure according to solution 1, characterized by modular electronic devices (30) that are oscillating or swinging circuits;
3. an artificial neural structure according to solution 2, characterized by oscillating circuits which are complex oscillators (15, 16) essentially comprising elementary RLC components, isolated or grouped together, such as resistors, inductors and capacitors organized in meshes;
4. an artificial neural structure according to solution 3, characterized by elementary RLC components which comprise components connected in series, in parallel or in a mixed series-parallel way;
5. an artificial neural structure according to solution 1, characterized by analogic electrical signals which are emitted in the light wave field;
6. an artificial neural structure according to solution 6, characterized by electric powers which are biocompatible;
7. an artificial neural structure according to solution 7, characterized by electrical powers which are computer-compatible;
8. an artificial neural structure according to solution 1, characterized by its connection between a first and a second group of biological neurons (23A, 23B respectively), at a first and a second intersynaptic space (24A, 24B respectively), being equipped with an input interface (25A), connected between a first intersynaptic space (24A) and an input terminal (IN), and with an output interface (25B), connected between the second intersynaptic space (24B) and the output terminal (OUT);
9. an artificial neural structure according to solution 9, characterized by input and output interfaces (25A, 25B respectively) which have contact probes suitable for transmitting suitable neuro-electrical signals to the first and second intersynaptic space (24A, 24B), these probes being similar and/or analogous to those used for brain stereotaxic neuronal-surgery;
10. an artificial neural structure according to solution 1, characterized by modular electronic devices (30) which operate basing upon a Na-K bionic pump model;
11. an artificial neural structure according to solution 11, characterized by modular electronic devices (30) which have a first, a second and a third circuit branch (31, 32 and 33 respectively), corresponding to the branches of the Na-K bionic pump model, the number of these branches being able to vary and being greater than three;
12. an artificial neural structure according to solution 11, characterized by modular electronic devices (30) which is able to generate at least five analogic signals (S_1,…, S_5) at internal circuit nodes;
13. an artificial neural structure according to solution 13, characterized by analogic signals which are transferred to a processing structure (31) having logic gates to obtain elementary information bands of the conventional and/or Fuzzy type;

14. an artificial neural structure according to solution 1, characterized by the fact that it is totally hardware;
15. an artificial neural structure according to solution 1, characterized by the fact that each mesh also comprises simple or double switches;
16. an artificial neural structure according to solution 1, characterized by resistors (R) which work in variable frequency fields and in predetermined time periods;
17. an artificial neural structure according to solution 9, characterized by the fact that it comprises a central section (21) responsible for the generation of analogic electrical signals, as well as a first and a second end section (22A, 22B respectively) connected to the central section (21) and to a respective input terminal (IN) and an output terminal (OUT) of the bionic neural structure (20); this first end section (22A) being suitable for collecting control signals received on the input terminal (IN) and for sending them to the central station (21), whereas the second end section (22B) being suitable for routing and amplifying the signals generated by the central section (21) towards the output terminal (OUT).

7. RESULTS

There was just a fundamental question to ask: *what were those universal model and elementary circuits that, working together, were enable to help or replace a neuron or a cluster of neurons which were inactive or damaged, or however distressed by irreversible pathologies?* The answer depended on a series of new approaches starting with Math, or it was better to say, on a new algebra coexistent with more diversified algebras. It was also connected with the magneto-flow-dynamics, the laser coherence, the quantum mechanics, the systems theory, the models theory, the complexity theory, the chaos theory, the Aristotelian logic, the fuzzy logic, the n-values logic, the uncertainty logic. It was based also on informatics, electronics, statistics, biochemistry, biophysics, the bio-regulation, tissues (see Figures 29 ÷ 32) topology, the feed-back chains, the connecting nets with the models for analogical simulations and other. These different and interdisciplinary approaches had to be harmonized. As a first step I structured a new Math in order to simulate a really human intelligence, completely innovative because it had to permit to resolve systems of systems of equations. I called it "cubic matrix algebra" (see References, 2nd part) and it was a really important result, a fundamental condition for the realization and the functioning of the circuits I simulated.

I had also an important intuition that led me to the formulation of the new neuron transmission model: I realized that there were evident analogies among the relation dendrites-axon and the relations finger-button-hole in a sax (Figure 01) and Neurotransmitter like Ball of Strings in the 4-dimensional Intersynaptic space (Figure 13).

At this point, I can only say that I was, and I am, working with a transmission model which consider obsolete the traditional model, which is better for rigid, aseptic and digitals tele-communications. This new model is otherwise more suitable to the *reality* because it is valid for bio-communications which are provided with bio-inertia in transmission and in receiving, and which are above all ***analogical***. In this new model, the neurotransmitters' flow is the same as a plasma–jet flow cone in physic-mathematics simulation (Figure 14).

In Figure 14, the black rectangles represent the messengers, while the colored ones represent their absence; in the column *Magneto-Hydro-dynamics Simulation* I show the flow cones in transmission and in receiving, assumed for the messengers' movement from a transmitter towards several receivers: the messengers' trajectories in iso-frequency are formed in these cones; in the third column (Electro-Bionics Simulation) we can see the transmitted or received trajectories which are produced in iso-frequency.

For the construction of the elementary simulation I started from the configuration of the mathematical relations among groups of neurons as represented in Figure 15 and I got and simulated electronically the final model (as it is reproduced in Figure 16) which has provided compatible signals as it is shown in Figure 17.

Each neuron receives and transmits with its own, also temporarily variable, configurations. Little variations in the structure or in the true and real object of the neural communication, can produce schematizations which can be also very different (or I dare to say quite dissonant) among them if not considered true bifurcation points. Just as in the chaotic systems. Therefore at a medium or long term they are unpredictable in their communicative behaviours.

We know that we have also to consider the small errors that can lead (or are due) to losses of informative amounts (digitally, "*bits")*. The neural activity is obviously communicative but it is of an analogic type. In nature there is nothing working digitally. Everything can obviously be digitized but constructing and using some filters that, just to remove the maximums or the minimums on frequencies or on amplitudes, they could eliminate parts of signals maybe exchanging them for noises or other.

Nothing is redundant in the human body and if does exist there is a good reason. I am strongly convinced that only the introduction of a more advanced generation analogic chip can simulate the whole human body as a complex and chaotic system. When I speak about the possibility to communicate I try to mean that everything can be communicated but we need the right syntax, the semantics and the logics which can be reproduced to an informative level. There is a great difference between communicating a noise and communicating information.

A sign is usually transformed in a symbol only if it is understood. Therefore we need coders and decoders homogenous among them. What is transmitted among neurons is a codified signal they can recognize. If we want to communicate artificially with them we must use the same language with the same interpretative codes. Otherwise we would transmit them only electrical signals just compatible but also easily misunderstandable.

Figures 18-19 are an example of analogic simulated artificially analogic signals.

Using the Fourier's analysis, in series, we can demonstrate that, for every sequence of bionic emission, there are various harmonics which are similar to those from natural neurons.

Figures 20 and 21 show my results concerning the third component (i.e. the condenser: see point X12 of Figure 7).The third component (the condenser) is a particular component in which all the other simple intracellular signals, defined by their resemblance to physiologic intracellular signals, are combined in order to produce extra-cellular signals.

It is therefore the fundamental component for the neural simulators charge and discharge. In Figure 20 we can see the potential and intensity current development and the development of the Fourier series, of the same component. The frequency distribution is clearly optimal for the bionic dialogue among, not only the neuron (the signal target), but also among all the other cells nearby, creating, in this way, synchronicity among the interconnections. But other waves can be noticed from this circuit: for example the values we obtain are similar to the intracellular signals and to those signals which, opportunely combined with the discharge element (the third condenser), are similar to the extra-cellular ones".

If up to some years ago we believed that the neural information transmission occurred through the pre-post-synaptic connection between two neurons and that nothing was interposed, we have later noticed that in reality it seems to occur in presence of glial cells (atrocities) that not only incorporate the "*pre*" of a specific neuron considering the "*post*" of the following neuron, but also they are interconnected with many others that surround them.

I had to notice this when in my simulations I evaluated the upper harmonicas of a transmission (Figures 20-21), and I could calculate the quantitative of energy that was apparently dispersing, looking redundant considering a single neuron-target. It was then that I understood that the apparent dispersion was like a cloud, that I simulated like the cone of a plasma-jet, which collide with a neural surround, and in this way all what was considered the boundary was informed of that happened on and about the fundamental neuron-target.

The simulation was made on the concrete neural ability to transmit, i.e. either biochemically through mediators and electrically through contact: the first way was unidirectional while the second was bidirectional. Just to have an approximate idea of what I could obtain on the upper harmonicas with the simulated NA-K similar-pump see Figures 22-26 (*Hz variable*).

I have obtained these results with the introduction of the general module of simulation (see Figures 27 and 28) which is the essential element of a linear or planar or three-dimensional interconnection for the study of the neural communication and for the construction of neural tissues (see Figures 29 ÷ 32).

This basic element achieves the bio-artificial behaviour proposed by the new neural communication model as a variation of the Hopfield's (see, also, Figures 27 and 28).

At last, in Figure 33 is the Bionic Coupling.

8. CONCLUSIONS

As we can see the object of this study has a highly complex systemic content and contributes to Systemics in general and, in particular, to the following sectors:

- Cybernetics, Automata, Robotics;
- Systemics and Medicine.

The object of this study was to simulate an elementary electronic circuit which could produce signals that were similar to those produced by intracellular and extra-cellular circuits.

I planned and simulated a new type of neural transmission model that considers every single neuron as the receiver of ***n*** *signals* and as the generator (in answer) of n^k *signals* partly in traditional logic and partly in fuzzy logic.

The results, obtained in the course of several experiments of computerized circuit simulations, are comparable to those produced by neural circuits that are described in the literature. Based on these results I think that we can create bionic (artificial) cells which can functionally act like stem, glial, or other kinds of biologic cells. I have at last obtained a fusion between Neurosciences and Robotics that lead to *Cyberneurophysiology* [(3)] and from this to *Bionethics* [(4)].

Stated the outcome of this work, even if with an extremely simplified model of a single circuit of a single form-circuit, the theoretic bases are, at the moment, the most completely possibly configured. I'm also convinced that today the technological research can easily supply the instruments to assemble and use it.

A last theorical-theoretical consideration

We know that the mass is one of the ways to be of the energy that is constantly connected to those processes that, at a microscopic level, occurs among abstract -at a dual character- separated entities that show a "*tendency to find themselves"* in a determined place with a certain "*tendency to happening*". This occurs with the "waves of probabilities" which represent the possibility of interconnections. There are no separate nor even separable "fundamental bricks", but there is "only" a complex net of relations among the different parts. We are moving within the world of the relational complexity. But we have also the problem of the non-linearity which is a characteristic of the chaotic world. It often happens that deterministic simple equations can produce unexpected behaviours. And also that a complex and apparently chaotic behaviour can give origin to ordered structures.

In an unstable system, little changes can produce "strange" effects for feedback, self-reinforcement and self-powering processes. The non-linear equations do not allow making exact predictions, but not even linear equations can give exact result and the measurements that need for the conditions at the limits, are subject to measurement or reading errors. From the quantitative analysis and from the measure, we have to move to the qualitative analysis and to the topologic characteristics. Resolving all the problems in a structural analogy with the space or the space-time is for sure a good measure of the knowledge of the relationship with the truth. Just in the sense that a unitary research in the world of the physics must start from chaos and complexity to go back (in a narrower range) to the quantum and relativistic "classic" conceptions till Newton and Galileo.

At the beginning of my researches I had several different questions to answer that were fundamental for me, some of which were:

1. if it is possible that a trajectory is transformed in a distribution function;
2. if the operator, necessarily to introduce in this case, is the analogous complex of an Hamiltonian;
3. in which cases the thermodynamic equilibrium laws remain invariant and on the contrary in which one they are "varying";
4. which are this variance parameters;

5. after how much time we would be in a position to estimate eventual differences;
6. if the physical usual symbology for the binary notations introduction can be abandoned;
7. if these notations would be valid for Biochemistry translated on the pure biological plan in which also the rules of the uncertainty are valid;
8. if we can work in analogy with the symbolic logic positions, transforming the physical laws in a kind of tables of truth which include the indetermination;
9. if a traditional logic is coherent with the (either symmetrical or above all antimetric, as in the case of life) truth;
10. if a scientific demonstration proves the physical truth.

With the simulations described in this Paper, I give a plain or at least partial answer to some of these questions. The *human* system is an autopoietic highly complex system. It is self organized in a way that the totality is more of the sum of the parts as it provides a myriad of potentialities offered by the different relations and, at the same time, the totality is also less of the sum of the parts, as it concretizes only one of the potentialities offered by the different relations. Probably it partially activates them serially, i.e. modifying itself temporarily in parallel. It is a system whose study needs three epistemological connotations: an absolute time doesn't exist, an absolute space doesn't exist nor an absolute centre which can be the *source* (that irradiates) or the *sink* (that absorbs). A system in which everything is interconnected, interrelated, depending from (i.e. perturbed), and influential (perturbing) on. A system rich in several different complex and chaotic subsystems. It is the system of our life that continuously *moves towards* and *into* the chaos just to order it. The future consists of probabilities and only the present choice carry out a specific one and the scenario is purely dynamic. In this myriad of opportunities and solutions, Chaos is no more that a summary of dynamic equilibriums sequences. When a system lacks of balance, tends to get a new configuration at a different energetic value. We can notice this in the self-regulating "biological" system. The organism, just for its structure, is a self-regulating system. It has a feed-back control system al least of the second order. In my researches I assumed the human body as a geometric structure with the same morphology of the universe. The communicative biological signals move inside it essentially like the photons outside. We know for example that the intersynaptic exchange occurs through matter, energy and information. My neurons set neither can create matter nor can receive or transmit it, and so it by-passes this type of exchange, i.e. it is planned for immediately clutching informations and energy just before the source of the transmitter-neuron and for giving informations and energy just after the reception-sink of the receiver-neuron.

Biologically the neuron [whose axon works in an analogous way to the LINAC (linear accelerator, see Figure 04)] is characterized by an enormous surface in order to facilitate the exchanges. Artificially this can be carried out only increasing the number of the probes in reception or in transmission, articulating their mutual relationships and the most possible facilitating the coding. The cards, that I planned, completely simulate the different types of circuit (i.e. from the divergent to the convergent, from the recurrent to the parallel). They can also be connected with other similar cards, forming regular polygonal groupings (from 3 till 8 sides) which can be combined linearly, planarly and spatially. As we can easily notice, there is a remarkable coincidence with the real situation if we consider the paths that link the nervous centres. Obviously we can't yet transform the different neuro-states (which are still increasing and the more and more specific) in psycho-states. That is why we aren't able to generating, as an example, the conscience. Personally and for the moment, I have only obtained the possibility to create an inter-connectible hardware with similar elements, *that works without any software introduced from the outside but that is self-controlling and self organizing.* In this paper, the physical objects, like the biological ones, are substituted in the simulation with other physical (specifically artificial) devices.

9. NOTES

(1)

D. P. ERRIGO *(dpe@cyberbrain.eu)*
After obtaining the "A Level" Certificate at the Italian "classic" High School, and after his musical studies, he graduated in Chemical Engineering (magneto-fluid-dynamics researches and applications) and in Speculative Philosophy (as the foundation of Gnosiology, Epistemology, Sociology, Politics, Ethics and Religion). He is an expert in Robotics, Laser, Cybernetics, Plasma-Jet Propulsion, and in many other scientific and humanistic fields such as High Polymers, Neurophysiology, Biochemistry, Language Philosophy, and Science Philosophy. He is also an Independent Researcher, he is expert in neural-simulations, variable electro-magnets fields and bio-sociology of politics. For some years, he lectured in seminars in some Italian University faculties. He was also elected in the Italian Chamber of Deputies and was in charge from 1996 to 2001 and now he is member of the Italian Ex-Parliamentary "Cultural Affairs" Commission. He is also member of the Club of Budapest scientific committee. He is Co-Founder and Emeritus President of WCSA (World Complexity Science Academy, www.wcsaglobal.org), Musician, Journalist, Lecturer, he is joint-owner and editor of some publications: "Nuova Atlantide", (the WCSA periodical newspaper on the theory systems and complexity); "Nature e Culture" (on Culture, Science and Philosophy) and "New Life" (on the systemic Global Vision). He is also joint-owner and editor of the "www.cyberbrain.eu" website. He is the author of several scientific publications and papers, scientific communications and some patents. In his researches he uses the models theory and the systemic approach to chaos and complexity in socio-politics, robotics and neural-sciences fields. His researches are based on the traditional studies or literature regarding: Biophysics, Biochemistry, Neural-Physiology, Laser, Magneto-Hydro-Dynamics, Aristotelian and Fuzzy Logic, Informatics, General and Micro-Electronics, Bio-Regulation, Statistics Thermodynamics, Digital and Analogical Micro-circuits, Feed-back, Connecting Nets, Models for Analogical Simulations, Neural Science, and other.

(2)

Chronology of the Search of the Cyborg Plan

- **1963-**1993: theoretical formulation of the whole plan;
- 1993-1998: first experiments on simple circuits;
- September-October 1998: theoretical global simulation of the totality of the cerebral nervous system (PROT 1);
- November 1998: first electronic simulation on reduced to a minimum elements for the communicative paths screening (PROT 2);
- March 1999: simulation and construction of the pre-prototype with chosen randomized elements (PROT 3) (see Figure A);
- November 1999: informatics simulation and construction of the pre-prototype of the basic at high reproducibility modules (PROT 4) and official presentation (see Figure A):

$$\frac{\textbf{Volume PROT 4}}{\textbf{Volume PROT 3}} = \frac{\mathbf{1}}{\mathbf{10}}$$

$$\frac{\textbf{Capacity PROT 4}}{\textbf{Capacity PROT 3}} = \mathbf{77}$$

***"Legenda"* for Figure A**

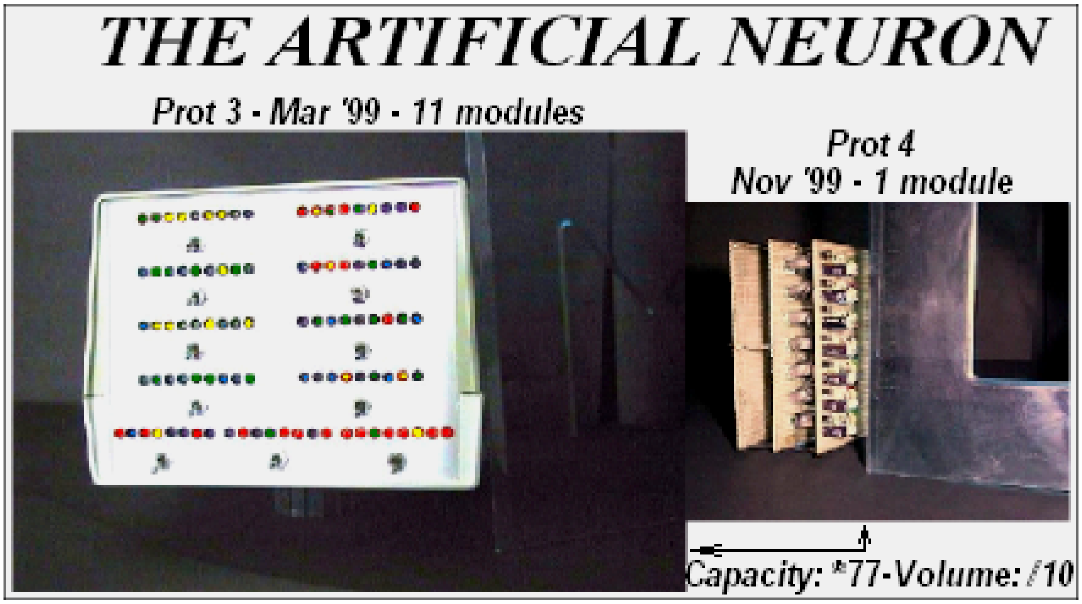

Fig. A

- December 1999: mathematical and informatics simulations of the universal basic communicative element (PROT 5). From this prototype on I make use of informatics simulation only.
- June 2000: study for the electronic simulation of the universal basic communicative element (PROT 6);
- September 2000: study for the electronic simulation of the universal communicative complete element (PROT 7);
- August 2001: the Universal Module (a PROT 7 variation) (PROT 8) Italian Patent Request;
- October 2001: Universal Module (PROT 9) simplifications;
- January 2002: universal module (PROT 10) implementation;
- March 2002: Universal Module (PROT 11) completed (practically, all the brain);
- October 2002: the universal module with all its ramifications (PROT 12): the whole brain with annexed and connected (afferent and efferent systems);
- December 2002: PROT 12 presentation at the Symposium of the International Neuromodulation Society in Rome.
- January 2003: the Universal branched Module simplification (PROT 13 - 1-2-3-4);
- March 2003: the universal simplified branched module implementation (PROT 14 – 1-2-3-4);
- May 2003: the configurations research for the protein and not protein peptides simulation (PROT 15 - 1-2);
- May 2003: the presentation of PROT 13 to the Conference Stroke Today in Spoleto (Italy);
- July 2003: research of the frequency -configurations for the standard messengers simulation (PROT 16 – 1-2);
- September 2003: the configuration transformation in a new structure with the connections for the right and left cerebral lobes and tissues simulation (PROT 17 - 1-2);
- October 2004: simulation of the protein coupling (bionic coupling) (PROT 18 - 1-2);
- October 2004: the Universal implemented branched module European Patent Request;
- November 2004: "Glycine" simulation (PROT 19);
- April 2005: theoretical approach for the neural dialogue (PROT 20 - 1-2);
- September 2005: neural dialogue electro-informatics simulation (PROT 21 - 1-2).

At present:

- simulation also of the calcium pump (after the simulation - from 1984 to 2005 - exclusively of the pump of Sodium-Potassium-Chlorine);
- biocompatible materials theorical analysis for the planning of similar-mildews to use as output and input probes;
- theoretical analysis of biocompatible materials for the design of interfaces cell-chip;
- structure of biocompatible materials for the construction of crystalline holographic memories implicated in input, output and feedback signals;
- after the amino acid Glycine (PROT 19) simulation, the possibility of simulation:
    - of the others 19 amino acids,
    - of the fundamental lipid (glycerol) structure,
    - of the nucleic acids components,
    - of the same nucleic acids [the target is: parts of DNA and RNA behavior simulations]. *(So as to obtain the perfect reversibility between the artificial and the biological),*
    - **PROT 7 simplification and digital similar–analogic adaptation to get different spin offs for diversified applications on the biological context (Figure B, KDK, a spin off).**

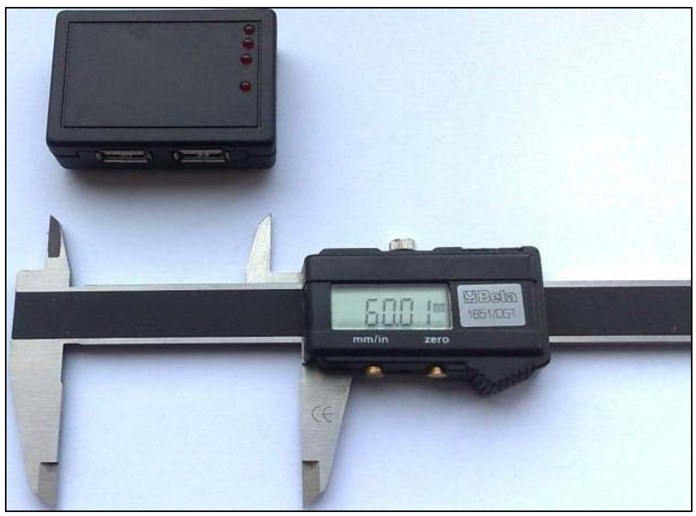

FIG. B

KDK is a small device for e-mail crypting and de-crypting in order to strictly safe privacy. KDK is external to the computer and connected through USB gate; it is programmed by the user in an individualized way and can be easily used to send and receive reserved messages in a safe way. In a easy to handle shape, it is formed by a pocket size box, containing 2 UBS gates and a transparent connection UBS to the PC, which can be used by whatever computer, making the message to pass through after being crypted. KDK device works in pair or in star; either for the couple or for the star links, it exist a principal box while the other, or the others, are secondary. Only the twin-link can de-crypt and eventually answer in an analogous way to the initial message. It is not necessary that the user of the corresponding twin-link pen drive must know the crypting key-files. The key-files are charged by the owner of the principal pen drive and the second or all the others, obviously programmed in the same way, work (receiving and sending) in link with the principal or among themselves. Compared to the traditional crypting algorithms which are inserted internally in the software of the computer itself, and so easily attacked by the hackers, KDK device is much safer because it is separated (transparent respect to the system) working like a simple pen drive small box to insert at need.

The prototype device KDK, compared to the traditional crypting algorithms which are inserted internally in the software of the computer itself, and so easily attacked by the hackers, is much safer because it is separated (transparent respect to the system) working like a simple pen drive small box to insert at need. The Crypting and Decrypting operations are locally executed by the KDK system without the help of the PC to which it is connected.

This system, not linked to a classical PC structure, doesn't use in the processing, an operative system like MS-DOS, Windows XP, Vista, W7, Linux… but it is based on a particular (similar-analogic) program which has nothing in common with other large diffusion programs like Word or others. This means that the files produced in the encrypting time haven't a structure which is, one way or another, identifiable or comparable to other devices.

(3)

CyberNeuroPhisiology *-neologism-* (CNP: human body analogic artificial simulation) concerns an hardware simulated *apparatus*, autonomously self-structuring its own software which emits informative signals and permits analogic energetic exchanges and also self-configures itself with an increasing memory: i.e. a system which determines the structure that gives the function (and/or vice-versa), with memorisable analogic emissions and which, as a whole, is oscillation susceptible. In particular, it is a system creating an inclusive oscillations set among complex elements, that, internally and among themselves, could be synchronous or a-synchronous, and that permit intrinsic symmetries and net symmetries and probabilistic solutions in their global structure. Finally it is an artificial inter-communicating with his biological analogous Entity (see: Bionethics). The outcome of this communication is the essential problem that we have: as e.g. the successive and deriving problem concerning the D-H matrixes substantial incompleteness for robotic applications and some other analogous. Today we can find kinds of circuit that, with the VLS1 help, put at disposal Hopfield implementing variant circuits and other nets like ART1. In simpler models than ART, e.g. the feed-forwards, we use the descent-gradient/Hebb-rules which let to find a well defined training algorithm for NN: this is translated, among the other things, in simple multiplexer summative components. In the recurring nets, as in Hopfield', there are opportunely locked circuits making clustering operations easy. And these are some examples among a lot. I think, as it really is, that *biological* Nature does not use digital signals: she exclusively permits (because there is an energetic and temporal inertia connected to extra-currents) an also partially digitalized emission, with analogic signals towards every direction and time. That is to say that she determines quantized events whose discretized information follows a well precise quantum logic, but it is not subjected to the usual rules of quantum mechanics. Such discretized information must follow statistic, an so probabilistic, laws that are neither Maxwell-Boltzman', nor Bose-Einstein' or Fermi-Dirac, but intermediate and "including". As a matter of fact the weights calculus in Nature can not follow the mere artificial transmission circuits rules and so, e.g., it does not follow literally Kosko BAM that, always e.g., achieves stability as energetic minimum when the due to feed-back oscillations are completely damped. I am fully convinced, at least up now, that in order to simulate Nature herself, methods as the pattern-matching ones are not yet, and for certain aspects, fundamentals for the implementation of a system which is sensible to environment. In fact I think that *biological* Nature must have a kind of super-net which organizes the net's weights also through other nets' weights (but in an innovative way as to the traditional), and doesn't have a specific software successively inserted in his hardware. I.e. what Nature has organized "ab initio" is at the same time either hardware or software. In a simulated artificial super-net, the "sine qua non" condition is to put gnoseologically somewhere *a centre* which is the *global coordinato*r which can have or determine an intrinsic "almost natural" genetic super-algorithm that, at its turn, can sub-stay, as a foundation, to all those other genetic algorithms which constitute themselves as partial and specific innovative nets controlling and directing the whole. For this purpose we can define a barely formal but intuitive analogy that I tried to follow. The organism is like a super-net coordinating the whole (but of which we don't know the centre): the organ or the tissue or both are one or more partial and specific nets; and the cell is a single artificial circuits cluster simulating the biological in their complexity. I think that the true solution consists in starting from a correct circuit, identifiable also varying either the Hopfield neural transmission model and other mathematics referring models. Today my experimental outcome is the modelling of multi-stratus analogic chips as basement of a cerebral complexity super-parallel computer. It is an innovative hardware which needs no kind of software because it can autonomously, dynamically and automatically make it up "itself". The system does not only organize itself but it makes continually reference to itself, as it was autopoietic, i.e. it is based on processes and their reciprocal relations and among their feed-backs. In such a way, according to Maturana, the limits defining the natural organisms are fixed. But, as this case concerns bionic elements, we are here much nearer to Chew boot-strap (among hadrons), as there is the forming of relations nets among linked states, sometimes without a pre-established but probabilistically determinable, even if only dynamically, limit. At last in this way we can establish the interdependence between process and structure, which refers to a probable gnoseologic and epistemological end of the dichotomous and occidental mind-material comparison: the fundamental Manichean relation with all its implications.

(4)

Bionethics *-neologism-* **(Bio-N-Ethics):** in many countries there is a great interchange of ideas between a laic and a religious world vision. Bionethics enters in this debate, widening the laic vision and trying to enlarge the bioethics concept to an autonomous, self-sufficient and thinking engine (a Cyborg) that inevitably will be constructed within this century. Research is now trying to extend the studies on human ethic to implement the robots' memory just to fix in them relationship behaviour. It concerns "robonethics", that is a "techno-ethic" directed specialization. But this constitutes only a sectional and a merely human vision and so unfit to a global approach. Bionethics begins considering human beings at first only partially bionic, than still partially bionic but who can become almost totally bionic, up to totally bionic individuals. We must also consider how a partially or totally bionic individual could form or enter in a group, a community and a society, through his new active participation: that is a more or less physiologically different individual presence. That's why Bionethics becomes the new social living foundation: and from this we must derive a new kind of artificial intelligence plan (AI) asking mainly the following question: *"whom will the new Robot be image and likeness of?"* For this purpose some years ago Cyberneurophysiology is born with a long demonstration about an initial conjecture (or mental experiment) based on the existence of artificial behaviours emulating natural ones that can be transferred into reality (see: Cyberneurophysiology). Among the effects of this "transference" we also see emerging what forces to face new problems that is which is defined Bionethics: ethics applied to bionics. This appears no more founded on those factors that generally form the evaluation characteristics which are usually based on bioethics parameters or on the existing official, usual and uncompleted robotic project conceptions. The new concept foundation is based on a specific assertion:" the biological natural Entities sub-set and the Cyborg Entities sub-set, both emerging for differentiation, in their inner self or better into the set containing them (that is the complex society set), could be compared to particles sub-sets in evolution into a single, maybe also deformable, container-system". The Bionethics concept is born and nourishes itself in the overwhelming of the last human race taboo: that one of the brain substitution. The Brain-Mind identity, as is at present formulated, seems in fact to be the last obstacle. This can however be overcome considering the brain as a highly specialised engine, but just an engine, And this against restructionism that leads to a simplification that considers an existing fixed space in which mind, spirit and soul are located. While with this my new vision, they are cause and fruit of a global harmony: i.e. even a deep physic alteration does not remove or substantially alter their presence. A new ethic-moral, juridical and pedagogic problem arises connected either to this new vision feasibility and its comprehension or even to its acceptation that's the inter-relation with a new race which theoretically could emerge or derive from the actual.

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- D.P. Errigo: *Un nuovo modello di trasmissione neurale – 6: Modalità di trasferimento in una simulazione neurale: Parte 1°: verifica di massima delle strutture, Parte 2°: l'emisfero destro: il secondo modulo universale e le sue connessioni con il primo*, Nuova Atlantide (2000) Suppl. 1, 3 – 12]

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- D.P. Errigo: *Un nuovo modello di trasmissione neurale – 7: Modalità di trasferimento in una simulazione neurale: Parte 3°: il modulo universale definitivo, Appendice 1°, Appendice 2° alla parte III°: una breve considerazione sulla metrica del micro-universo sinaptico,; appendice 4° alla Parte III°: il Modulo universale che sarà oggetto di brevetto: verifica della struttura*, Nuova Atlantide (2000) Suppl. 2, 3 – 10 (Italian language).
- D.P. Errigo: *Un nuovo modello di trasmissione neurale – 8: Trasmissione artificiale operata in simulazione cerebrale: paradigmi ed analisi: le implicazioni Bio-Cyborg-sociologiche di un modello di trasmissione neurale*, Nuova Atlantide, (2000) Numero Unico, 3 – 13 (Italian language).
- D.P. Errigo: *Interazione di raggio laser con campo elettromagnetico ortogonale in regime di variabilità - premessa - le basi fisiche – I° Cap. 1 un'ipotesi su particelle elementari, atomiche e nucleari*, Nuova Atlantide, (1996-'00), passim, 3 – 6 (Italian language).
- D.P. Errigo: *Interazione di raggio laser con campo elettromagnetico ortogonale in regime di variabilità - premessa - le basi fisiche – I° Cap. 2 " In uno spazio definito come bosonico-fermionico è possibile isolare un pseudo-volume elementare in cui la misura della probabilità di un evento, in termini di coordinate canoniche, sia esprimibile come funzione della metrica e/o del tempo, parti I°, II°, III°, IV°*, Nuova Atlantide, (1995-'00), passim, 3 – 23 (Italian language).
- D.P. Errigo: *Interazione di raggio laser con campo elettromagnetico ortogonale in regime di variabilità - premessa - le basi fisiche – I° Cap. 3 Sulla trasformazione di coordinate, appendice, appendice al Cap. 3: riflessioni sull'equazione (13)*, Nuova Atlantide (1996-'00), passim, 3 – 9 (Italian language).
- D.P. Errigo: *Interazione di raggio laser con campo elettromagnetico ortogonale in regime di variabilità - premessa - le basi fisiche – II°: Cap. 1 Sulla Sin.-Gordon ed altro*, Nuova Atlantide (1996-'00), passim, 3 – 8 (Italian language).
- D.P. Errigo: *Interazione di raggio laser con campo elettromagnetico ortogonale in regime di variabilità - premessa - le basi fisiche – II°: Cap 2: matrice di spin e carica, Cap. 3 sulle orme di Yukawa*, Nuova Atlantide (1996-'00), passim, 3 – 6 (Italian language).
- D.P. Errigo: *Interazione di raggio laser con campo elettromagnetico ortogonale in regime di variabilità – Accadimenti fisici*, Nuova Atlantide (1995-'01), passim, 3 – 12 (Italian language).
- D.P. Errigo: *Interazione di raggio laser con campo elettromagnetico ortogonale in regime di variabilità – ancora sulle orme di Yukawa*, Nuova Atlantide (1996-'01), passim, 3 – 11 (Italian language).

11. FIGURES

Figures 01 ÷ 06: from Section 3.2

Figures 1 ÷ 33: from Sections 3.3 ÷ 7

All the Figures from 1 to 9, the 16th and the 28th, are only descriptive and simply outline the single elements total structure and function.

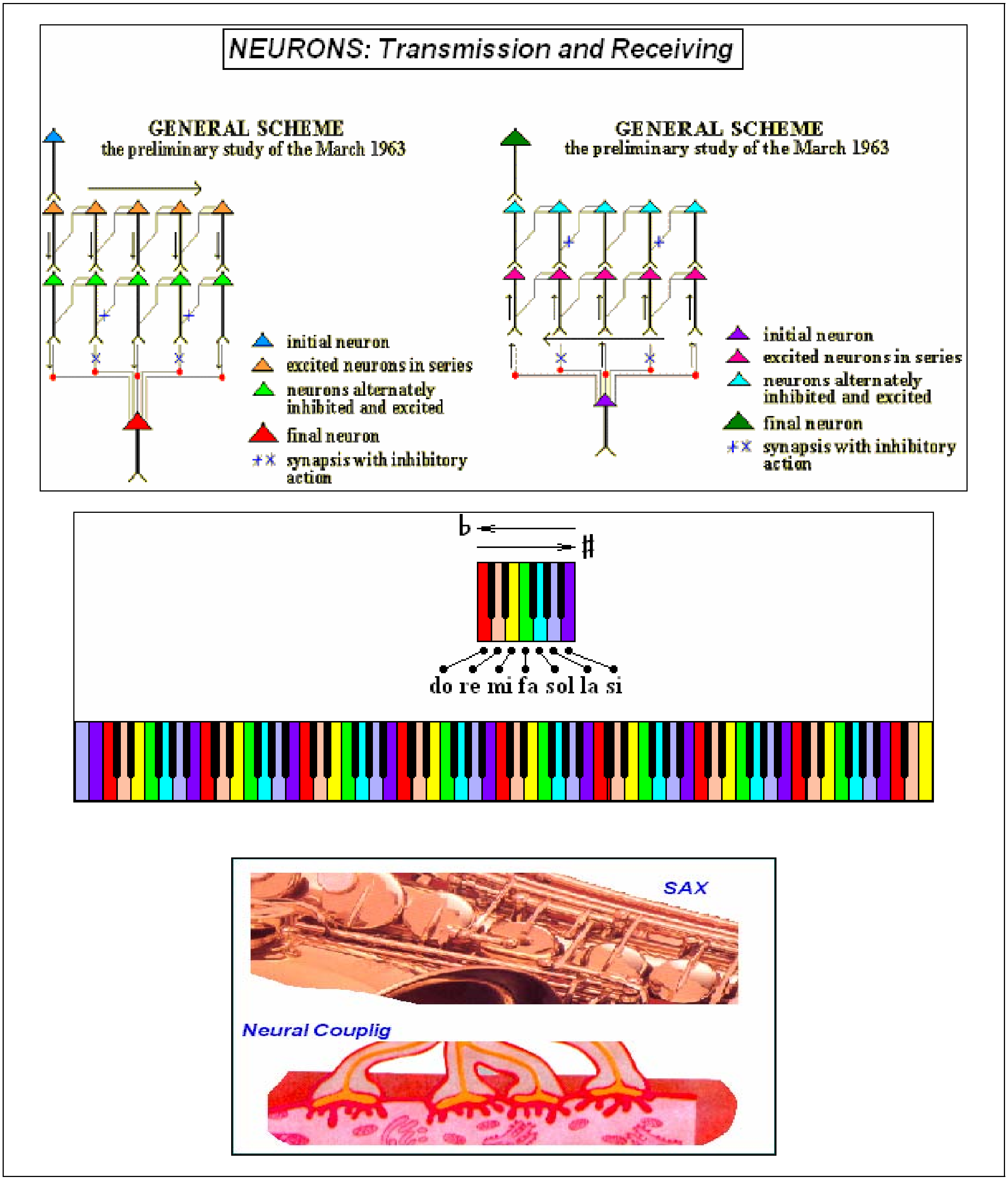
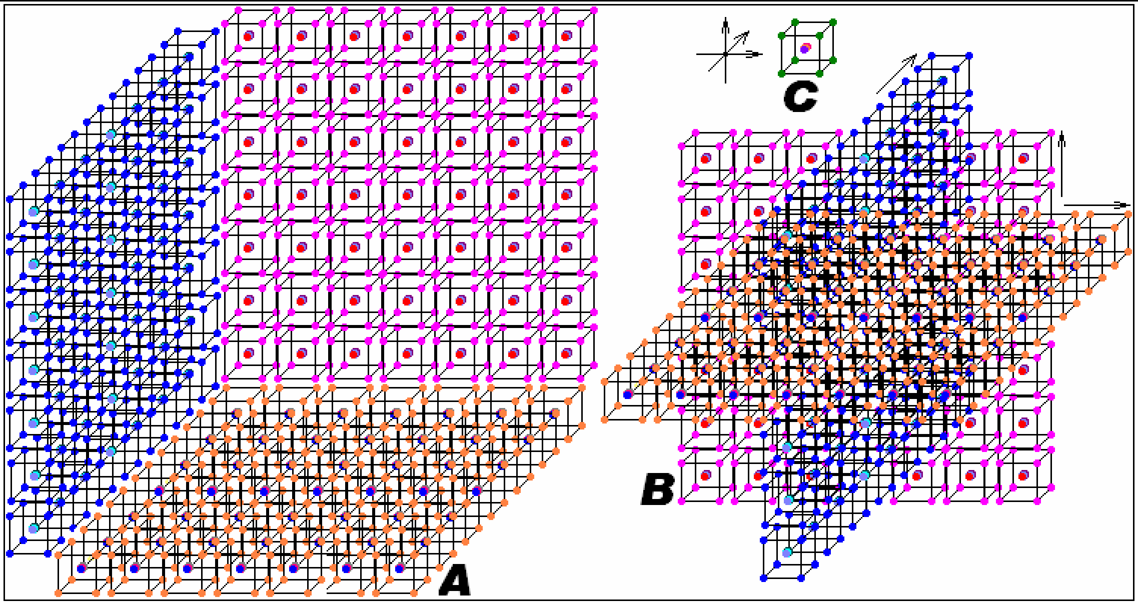
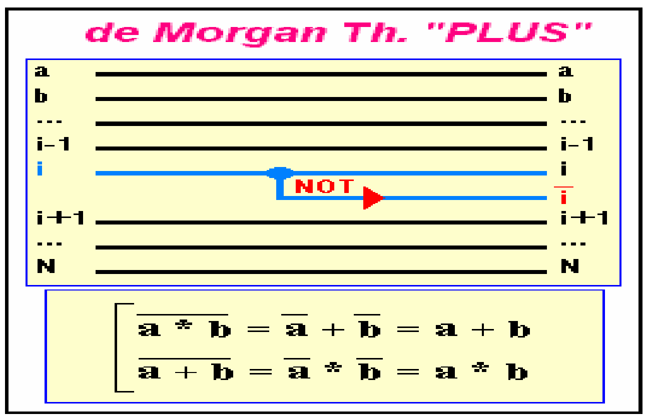

NEURONS: Transmission and Receiving
GENERAL SCHEME
the preliminary study of the March 1963
initial neuron
excited neurons in series
neurons alternately inhibited and excited
final neuron
synapsis with inhibitory action
GENERAL SCHEME
the preliminary study of the March 1963
initial neuron
excited neurons in series
neurons alternately inhibited and excited
final neuron
synapsis with inhibitory action
do re mi fa sol la si
SAX
Neural Couplig

FIG. 01



The Cubic Matrix



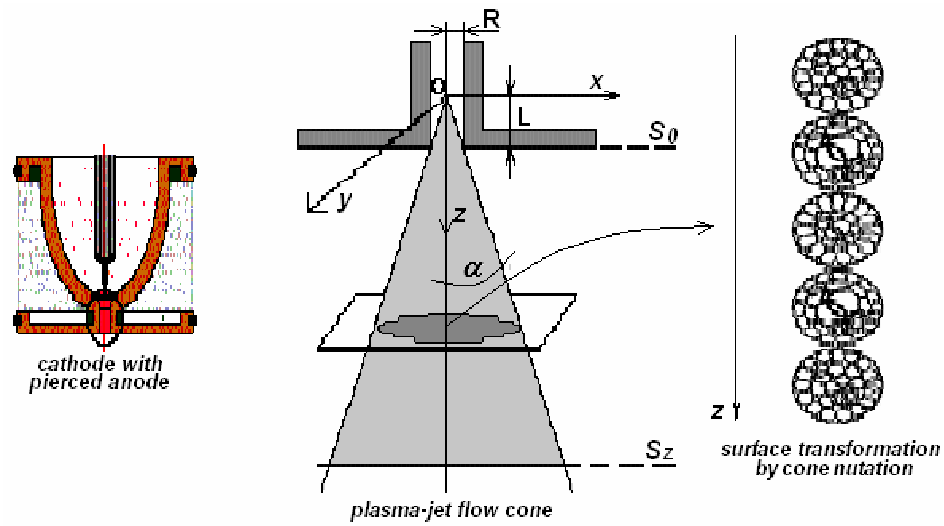
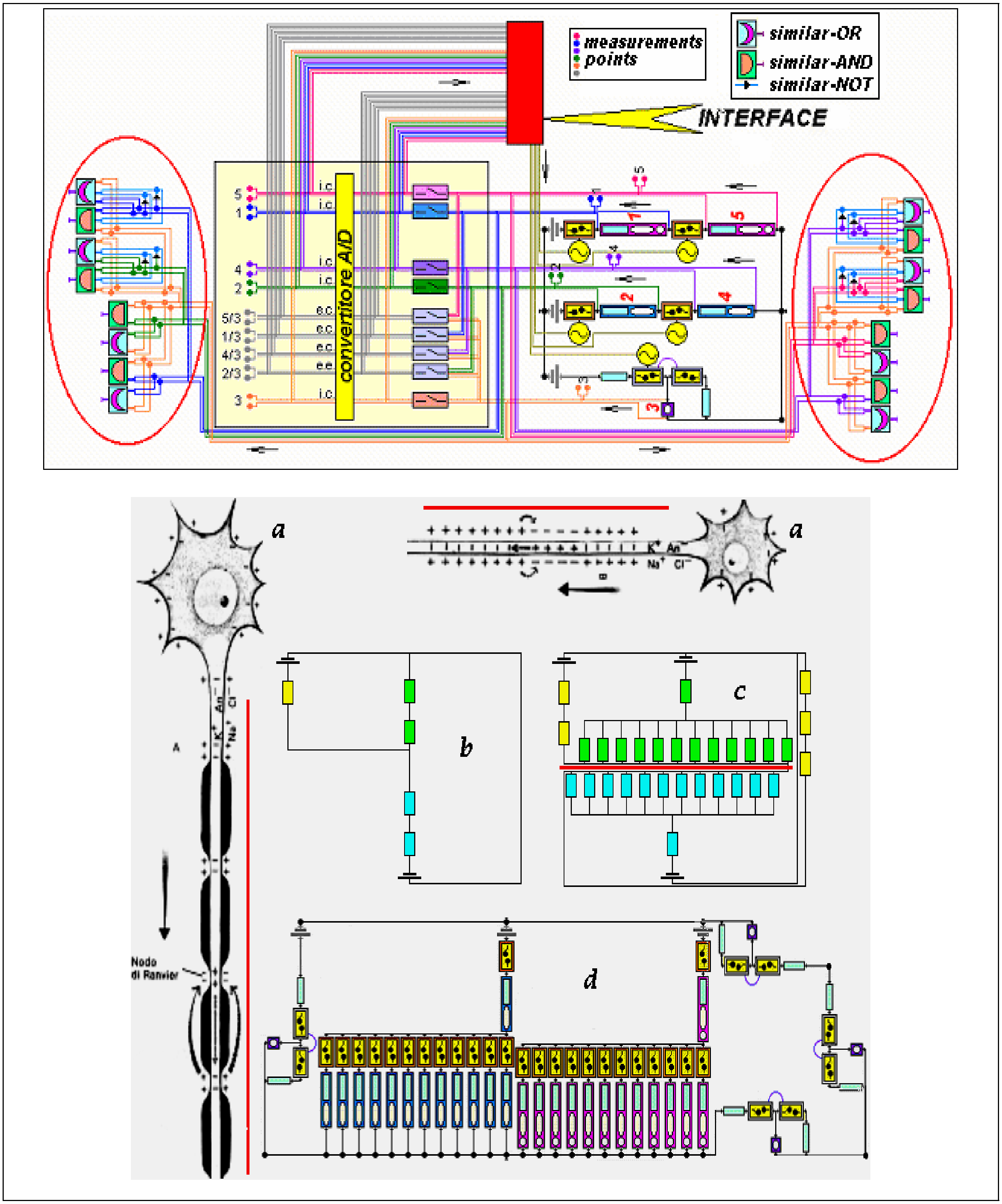
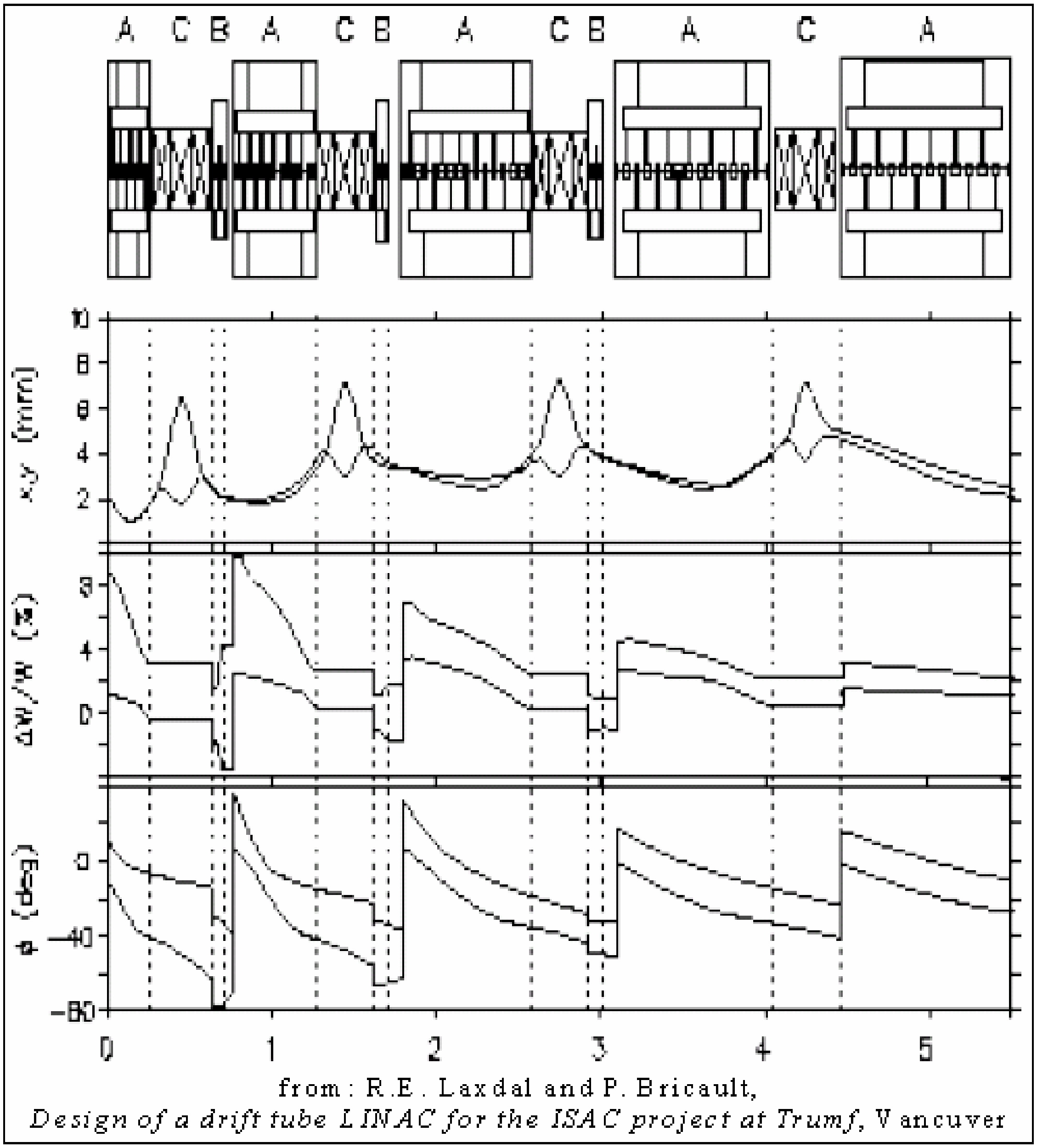


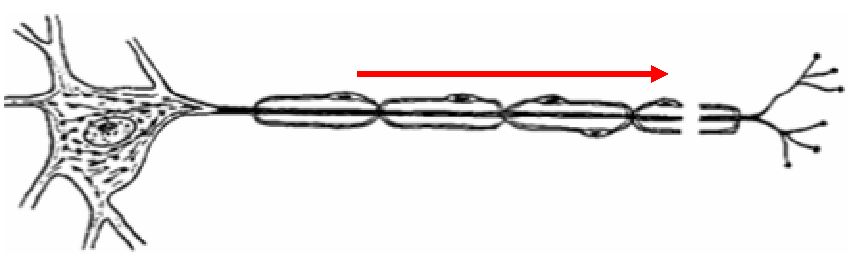
FIG. 02



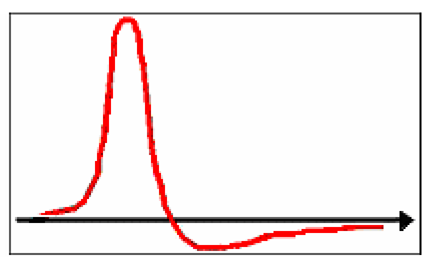
measurements points
similar-OR
similar-AND
similar-NOT
INTERFACE
convertitore A/D
a
b
c
d
Nodo di Ranvier

FIG. 03





schematic representation of a neuron



impulse

FIG. 04

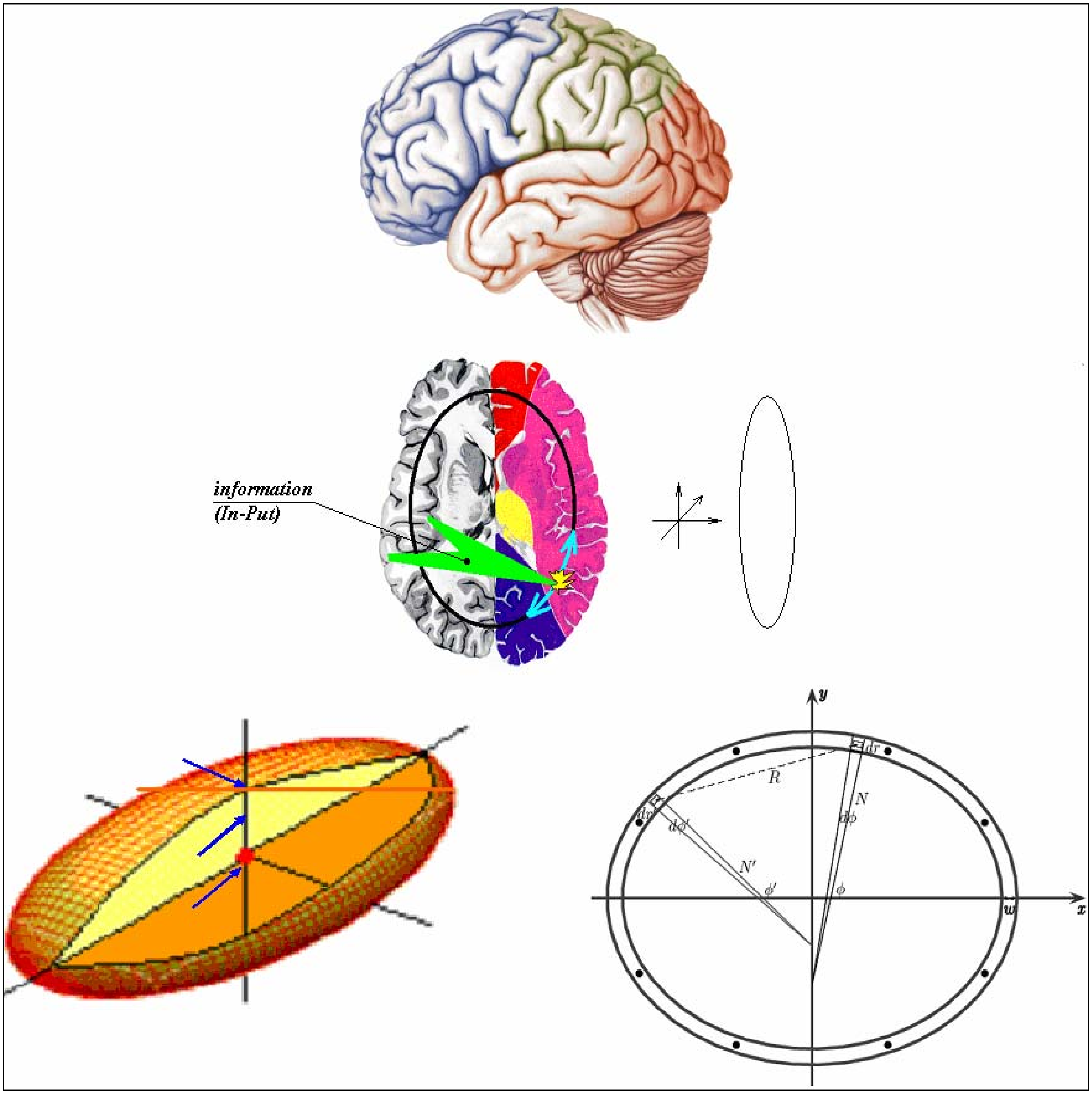


FIG. 05

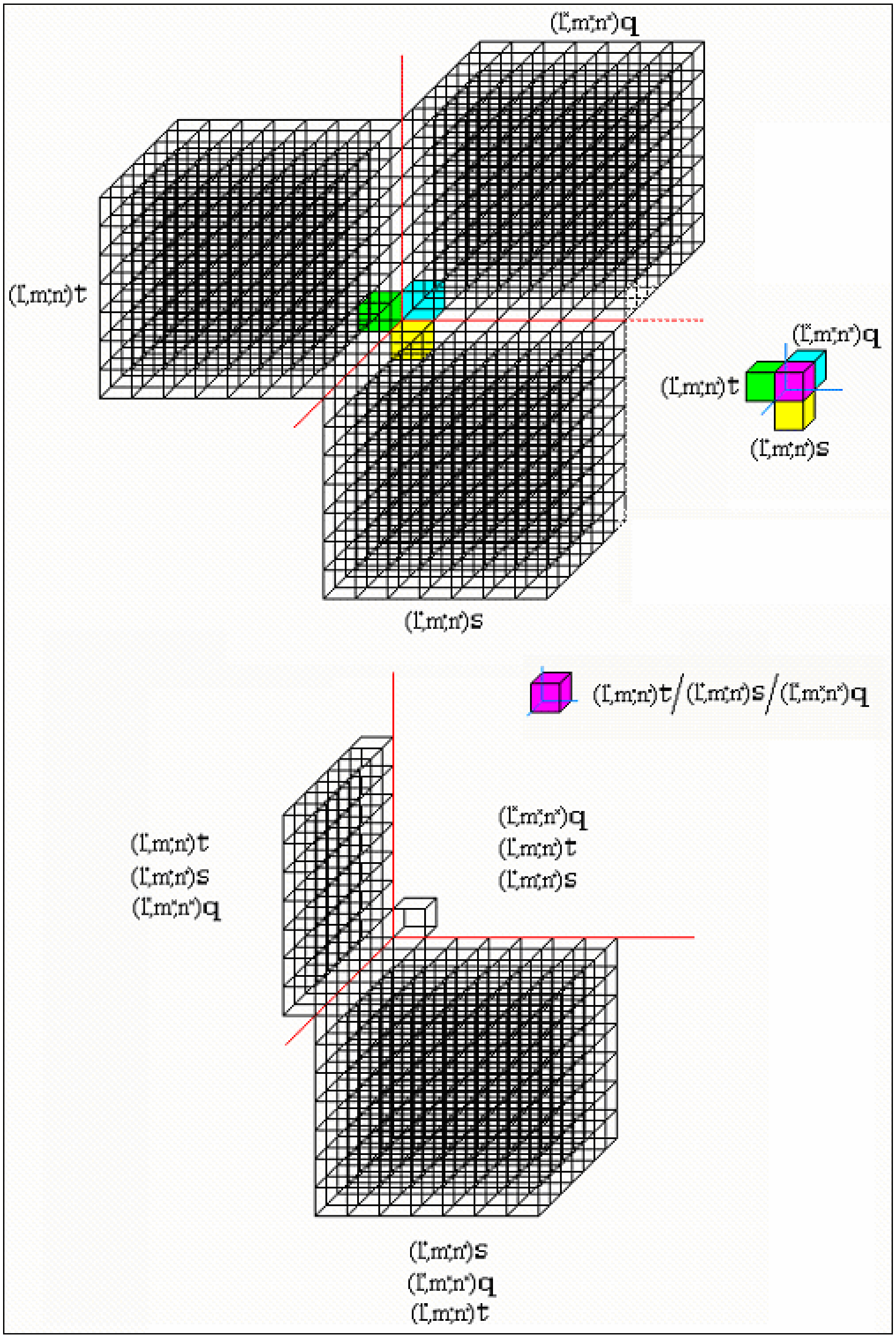


FIG. 06

s (sin.), t (train.), q (squa.): wave forms

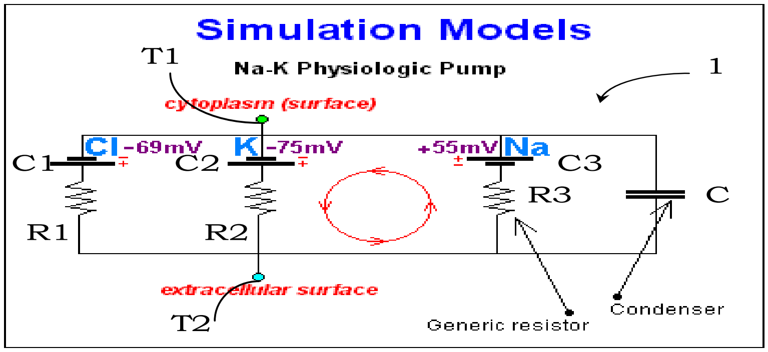


FIG. 1
PRIOR ART

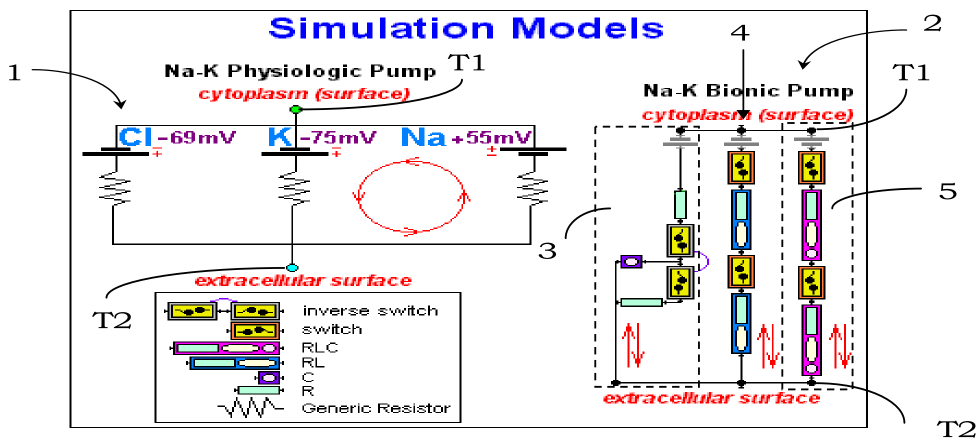
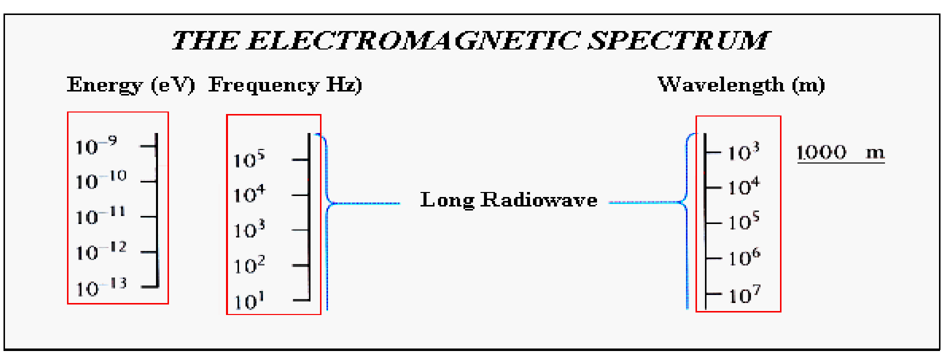


FIG. 2
PRIOR ART



(FIG.2.1)

One of the test (Hz) intervals for the switches

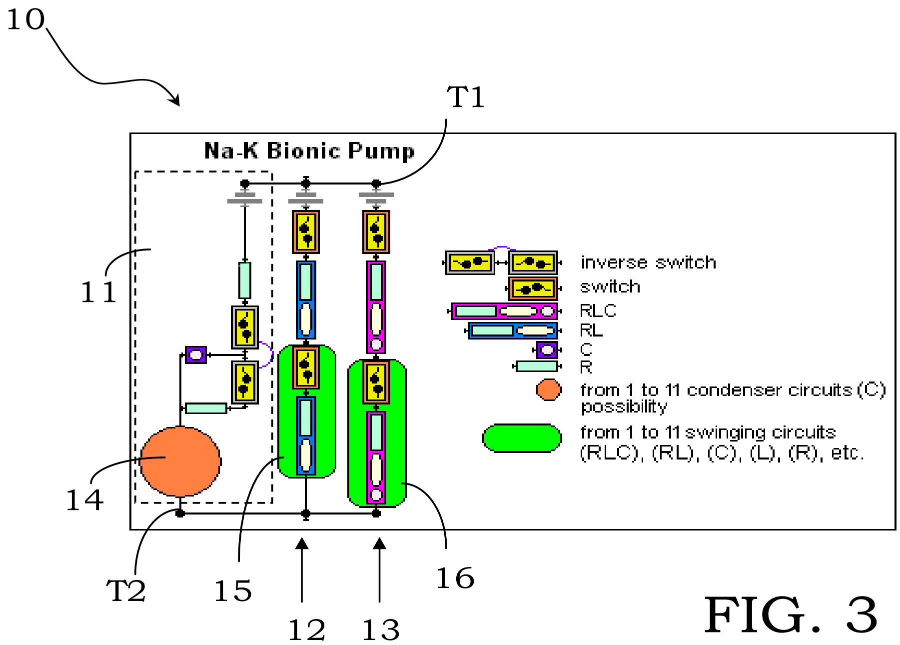

10
T1
Na-K Bionic Pump
11
14
T2
15
12
13
16
inverse switch
switch
RLC
RL
C
R
from 1 to 11 condenser circuits (C) possibility
from 1 to 11 swinging circuits (RLC), (RL), (C), (L), (R), etc.

FIG. 3

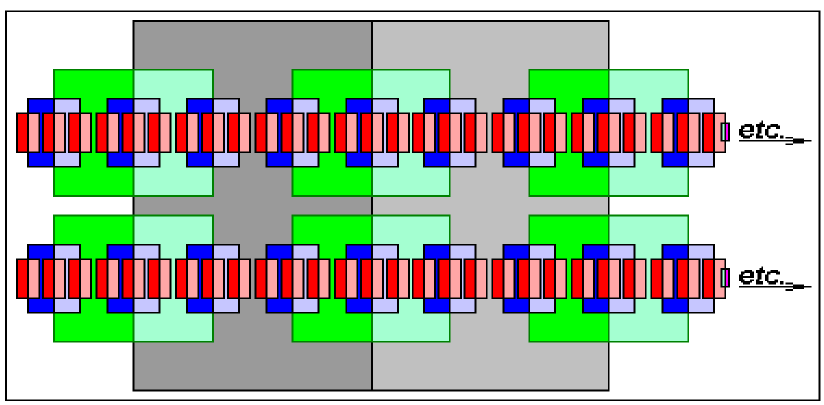

etc.
etc.

FIG. 4

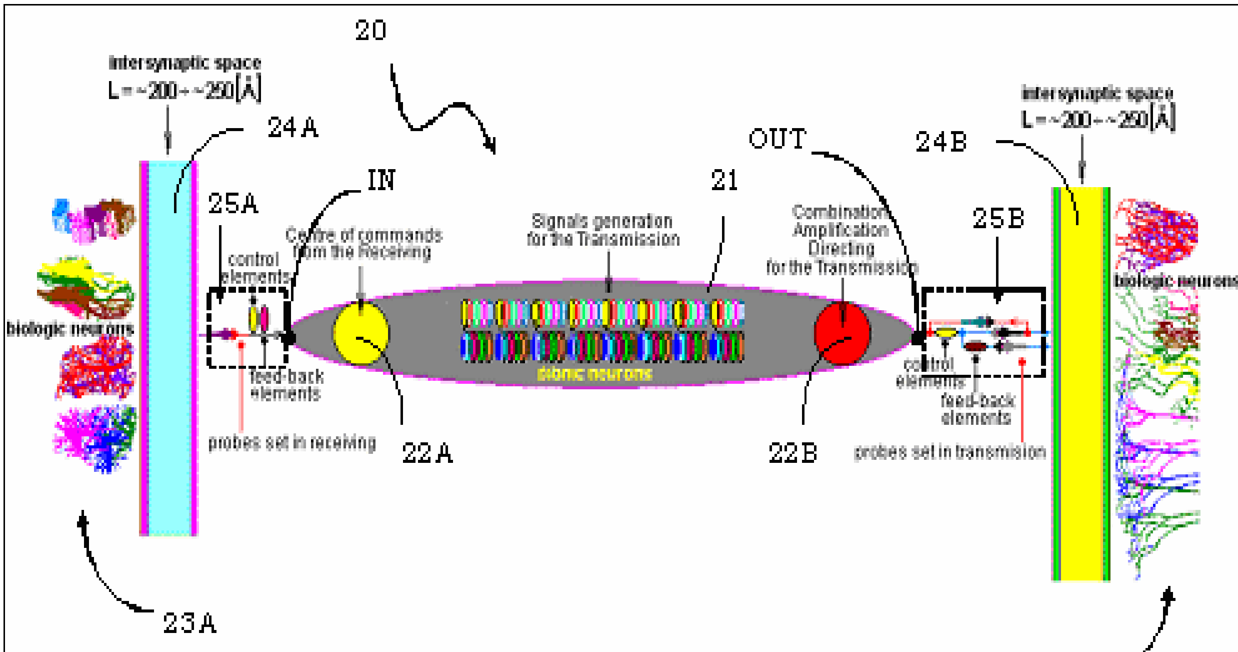


FIG. 5

3/8

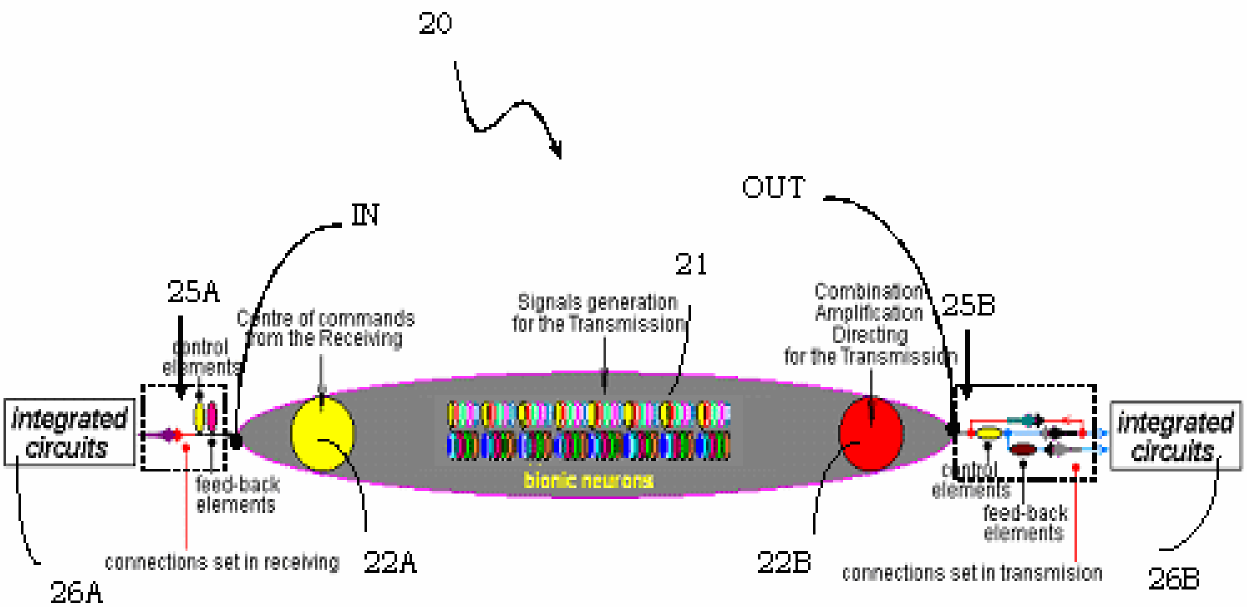


FIG. 6

4/8

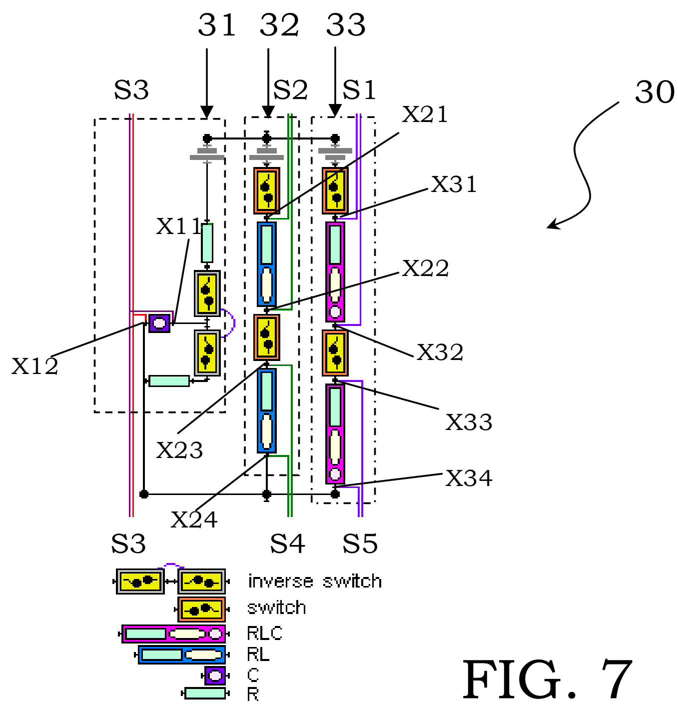

31
32
33
S3
S2
S1
30
X21
X31
X11
X22
X12
X32
X33
X23
X34
X24
S3
S4
S5
inverse switch
switch
RLC
RL
C
R

FIG. 7

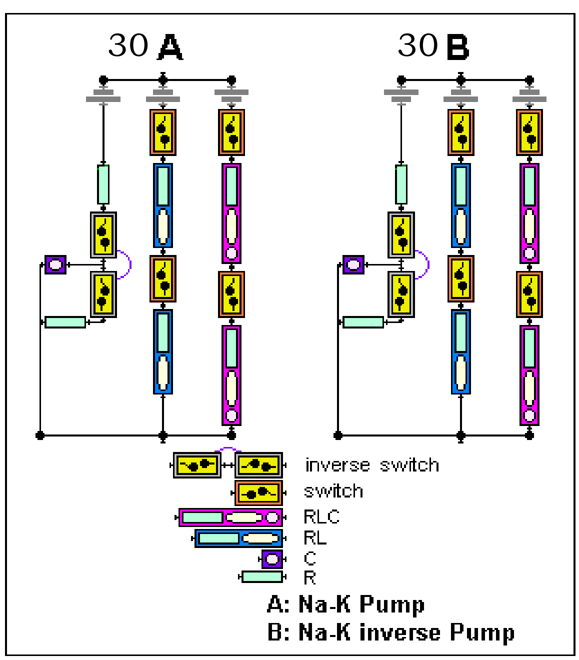

30 A
30 B
inverse switch
switch
RLC
RL
C
R
A: Na-K Pump
B: Na-K inverse Pump

FIG. 8

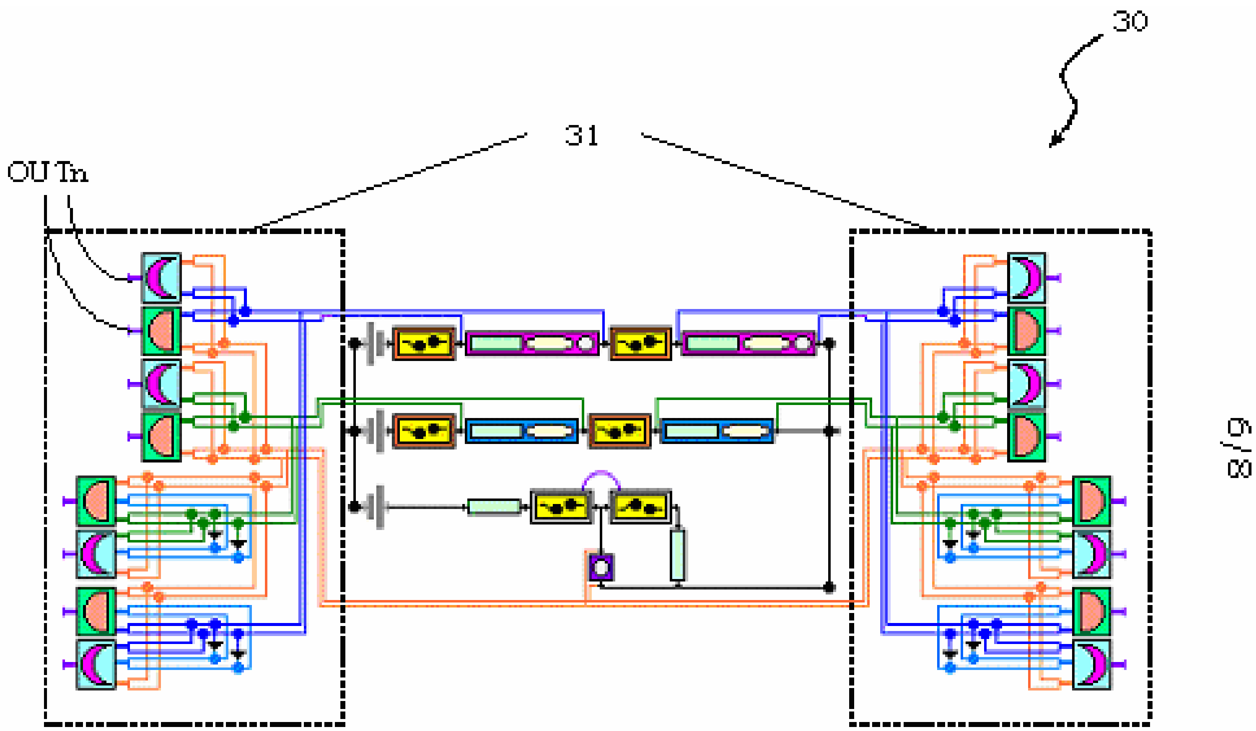


FIG. 9

6/8

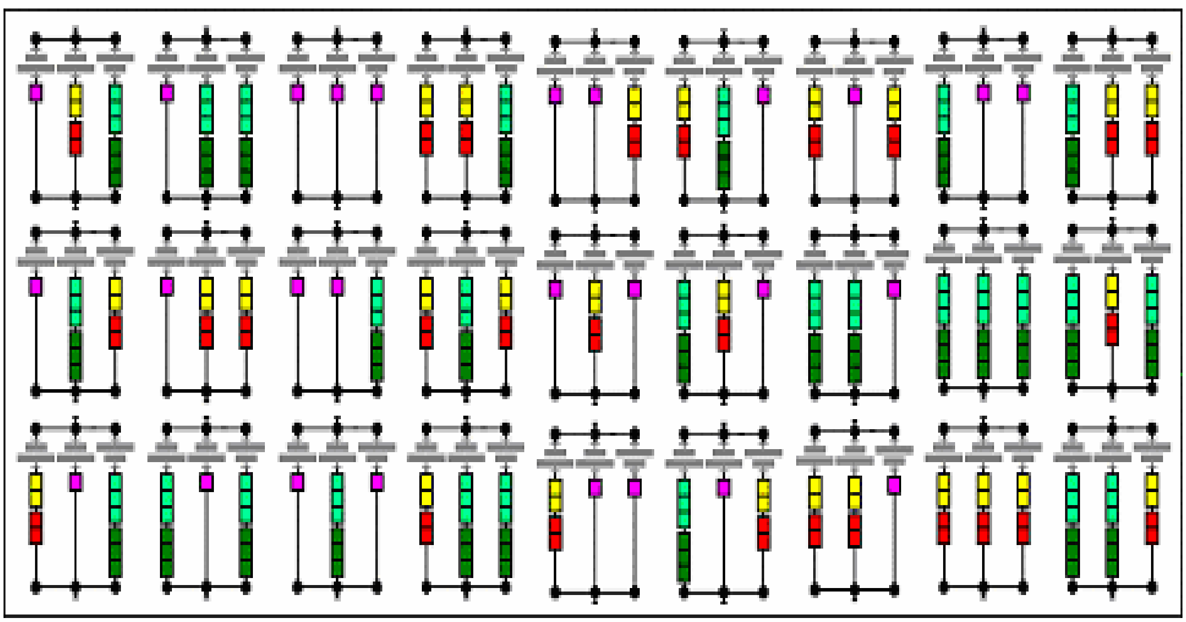


FIG. 10

7/8

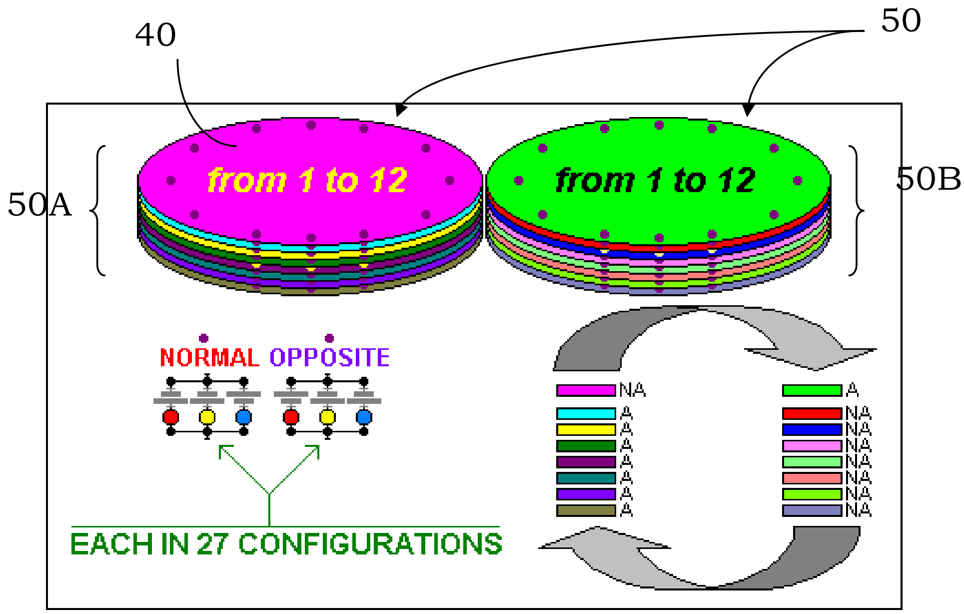

40
50
50A
50B
from 1 to 12
from 1 to 12
NORMAL OPPOSITE
EACH IN 27 CONFIGURATIONS
NA
A
A
A
A
A
A
A
A
NA
NA
NA
NA
NA
NA
NA

FIG. 11

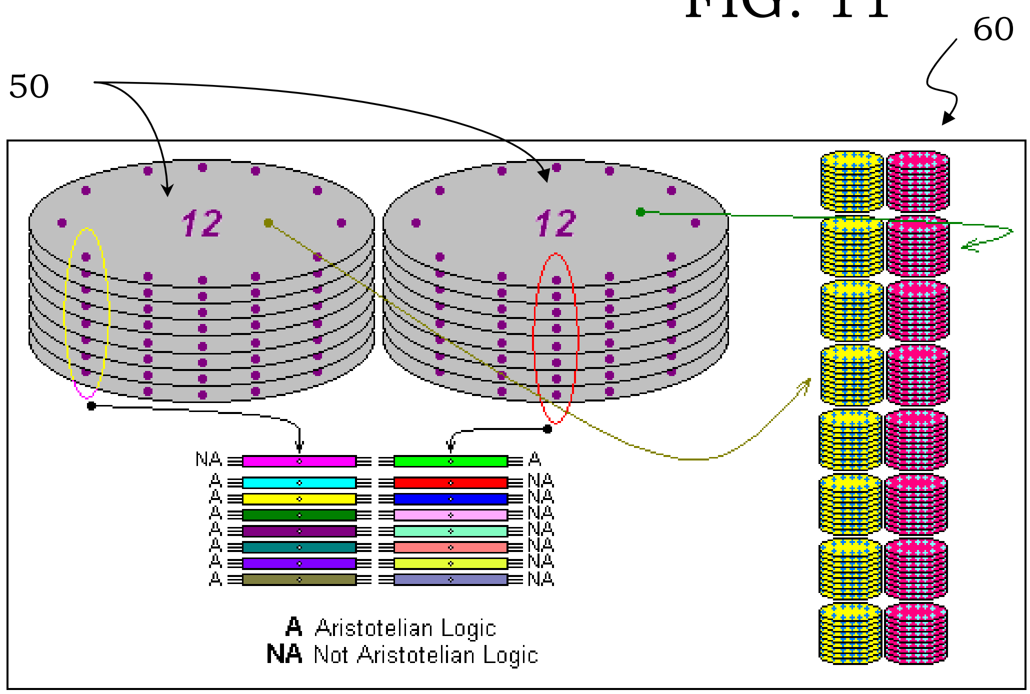

50
60
12
12
NA
A
A
A
A
A
A
A
A
NA
NA
NA
NA
NA
NA
NA
A Aristotelian Logic
NA Not Aristotelian Logic

FIG. 12

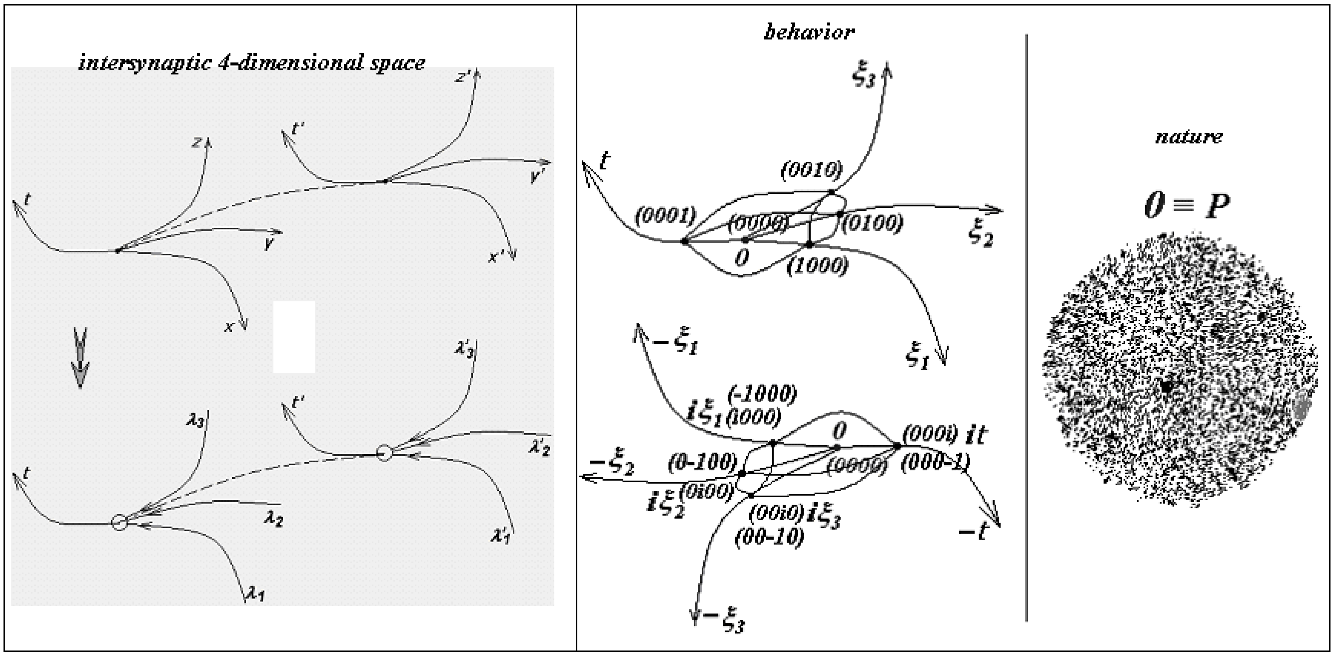

intersynaptic 4-dimensional space
behavior
nature
0 ≡ P
(0010)
(0001)
(0000)
(0100)
(1000)
(-1000)
(1000)
(0-100)
(0i00)
(0000)
(000i)
(000-1)
(00i0)
(00-10)

FIG. 13

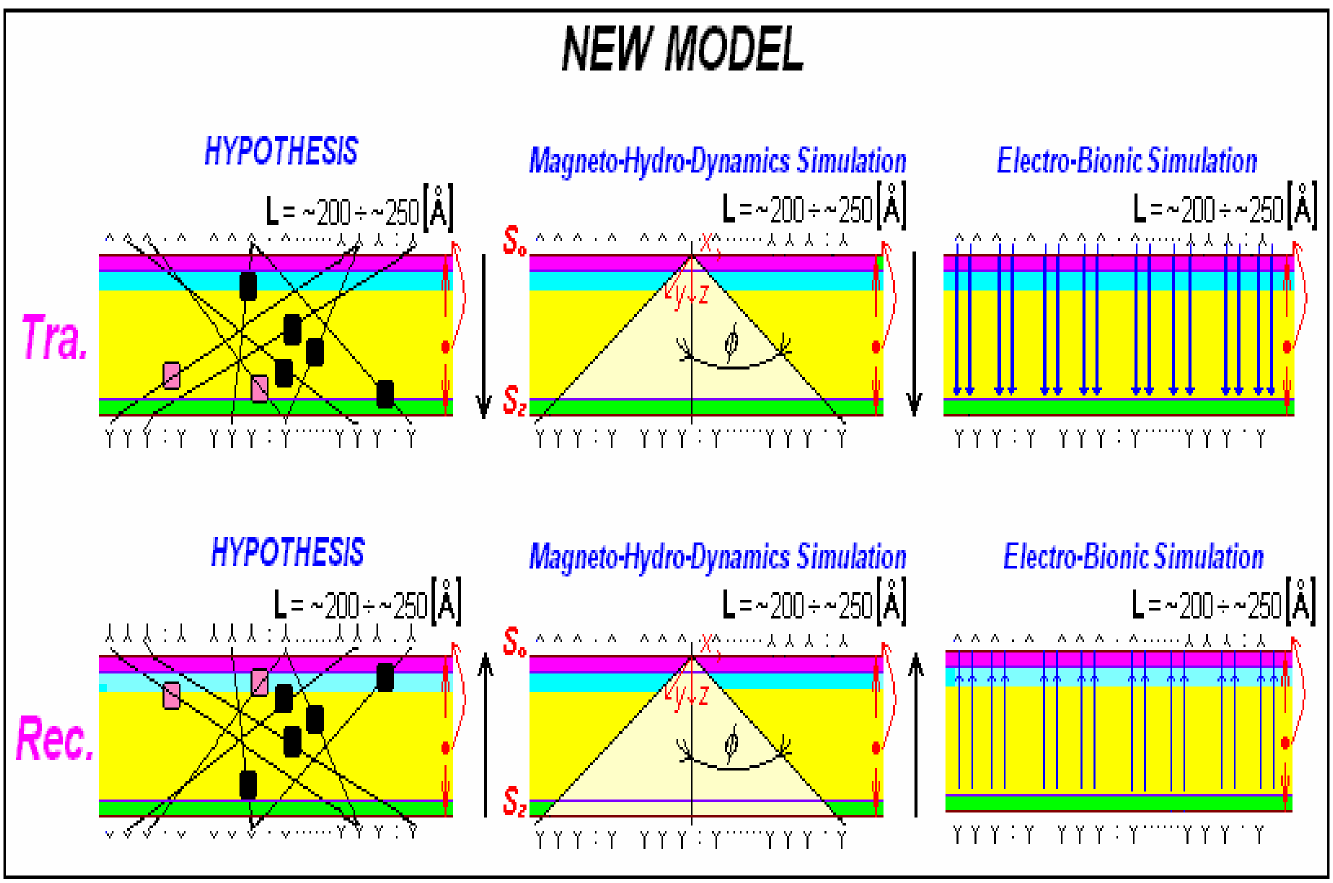
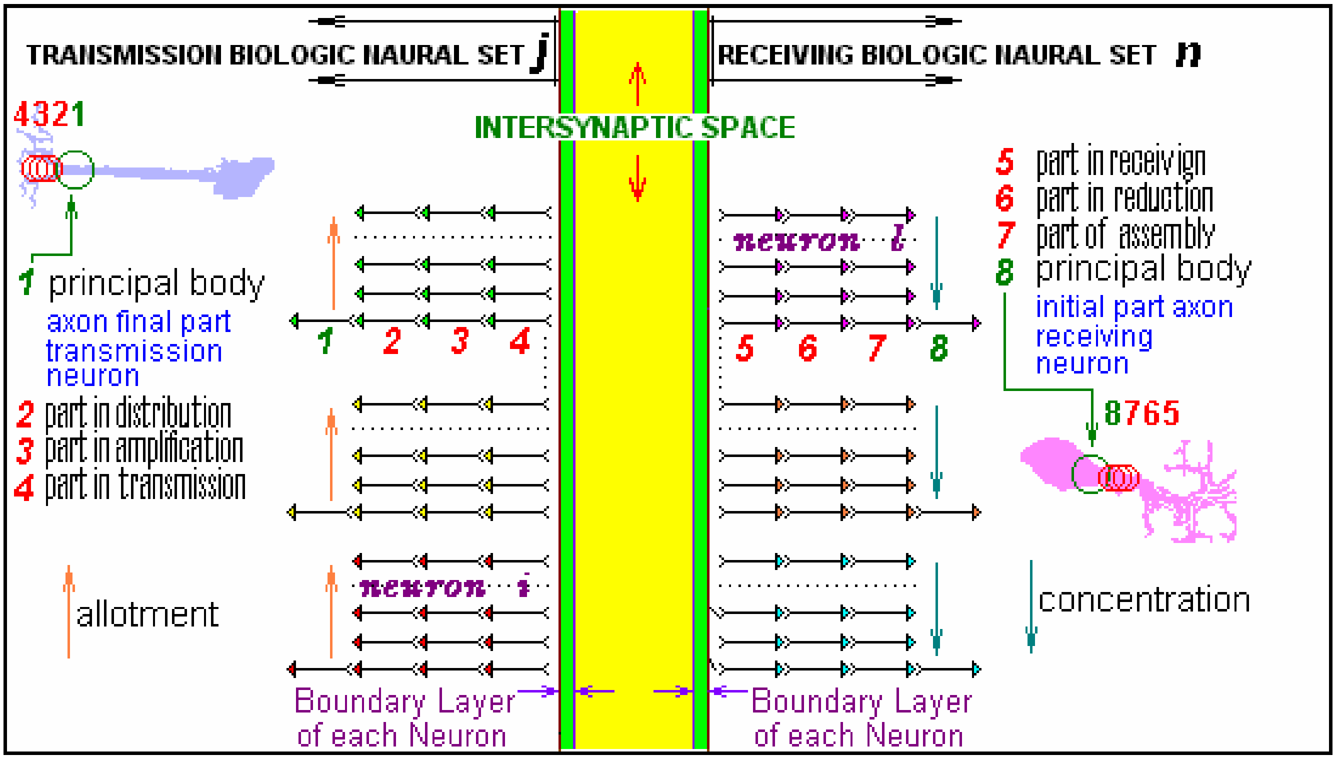
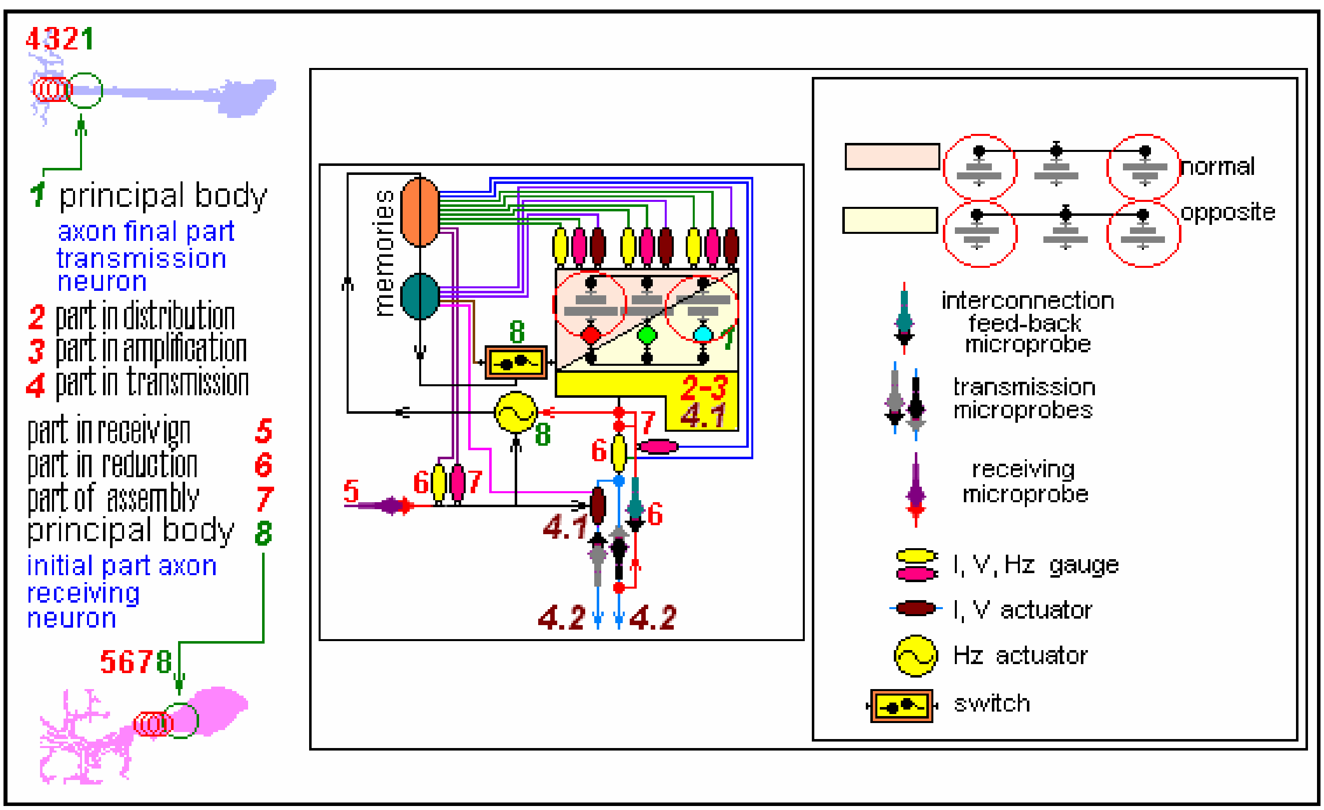

NEW MODEL
HYPOTHESIS
Magneto-Hydro-Dynamics Simulation
Electro-Bionic Simulation
L = ~200 ÷ ~250 [Å]
Tra.
Rec.

FIG. 14



TRANSMISSION BIOLOGIC NAURAL SET j
RECEIVING BIOLOGIC NAURAL SET n
INTERSYNAPTIC SPACE
4321
1 principal body
axon final part
transmission
neuron
2 part in distribution
3 part in amplification
4 part in transmission
allotment
neuron i
1 2 3 4
5 6 7 8
neuron i
Boundary Layer
of each Neuron
Boundary Layer
of each Neuron
5 part in receivign
6 part in reduction
7 part of assembly
8 principal body
initial part axon
receiving
neuron
8765
concentration

FIG. 15



4321
1 principal body
axon final part
transmission
neuron
2 part in distribution
3 part in amplification
4 part in transmission
part in receivign 5
part in reduction 6
part of assembly 7
principal body 8
initial part axon
receiving
neuron
5678
memories
normal
opposite
interconnection
feed-back
microprobe
transmission
microprobes
receiving
microprobe
I, V, Hz gauge
I, V actuator
Hz actuator
switch
2-3
4.1
4.2

FIG. 16

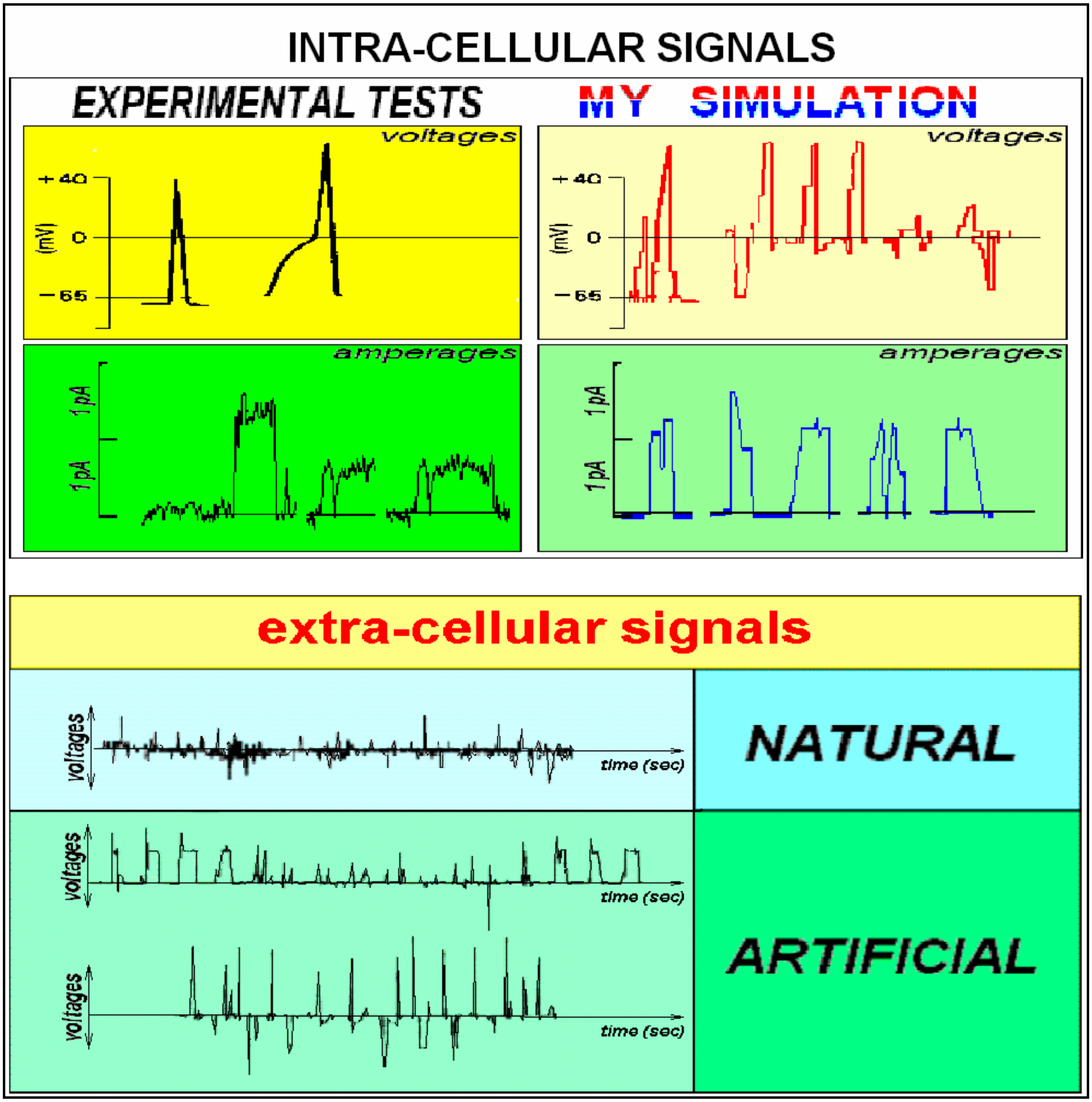

INTRA-CELLULAR SIGNALS
EXPERIMENTAL TESTS
MY SIMULATION
voltages
+40
0
-65
(mV)
voltages
+40
0
-65
(mV)
amperages
1 pA
1 pA
amperages
1 pA
1 pA
extra-cellular signals
voltages
time (sec)
NATURAL
voltages
time (sec)
voltages
time (sec)
ARTIFICIAL

FIG. 17

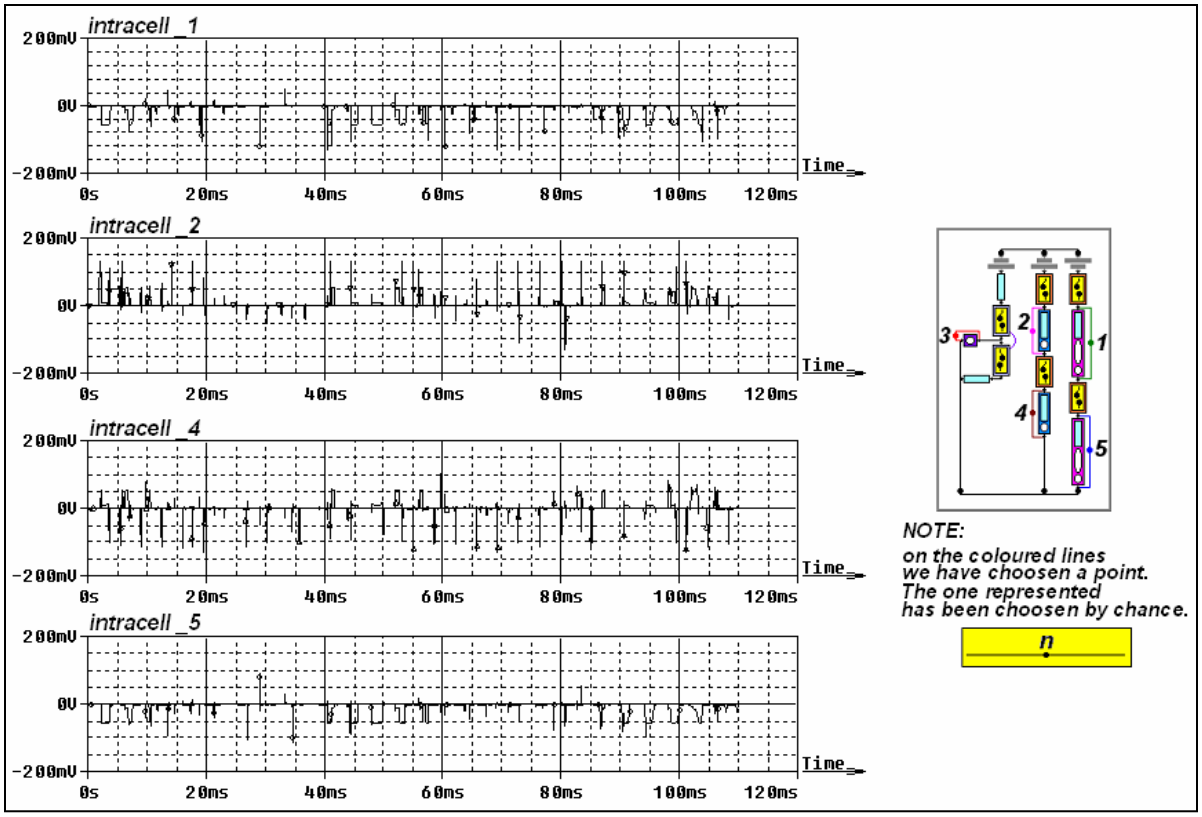

intracell _1
intracell _2
intracell _4
intracell _5
200mV
0V
-200mV
0s
20ms
40ms
60ms
80ms
100ms
120ms
Time
NOTE:
on the coloured lines
we have choosen a point.
The one represented
has been choosen by chance.
n

FIG. 18

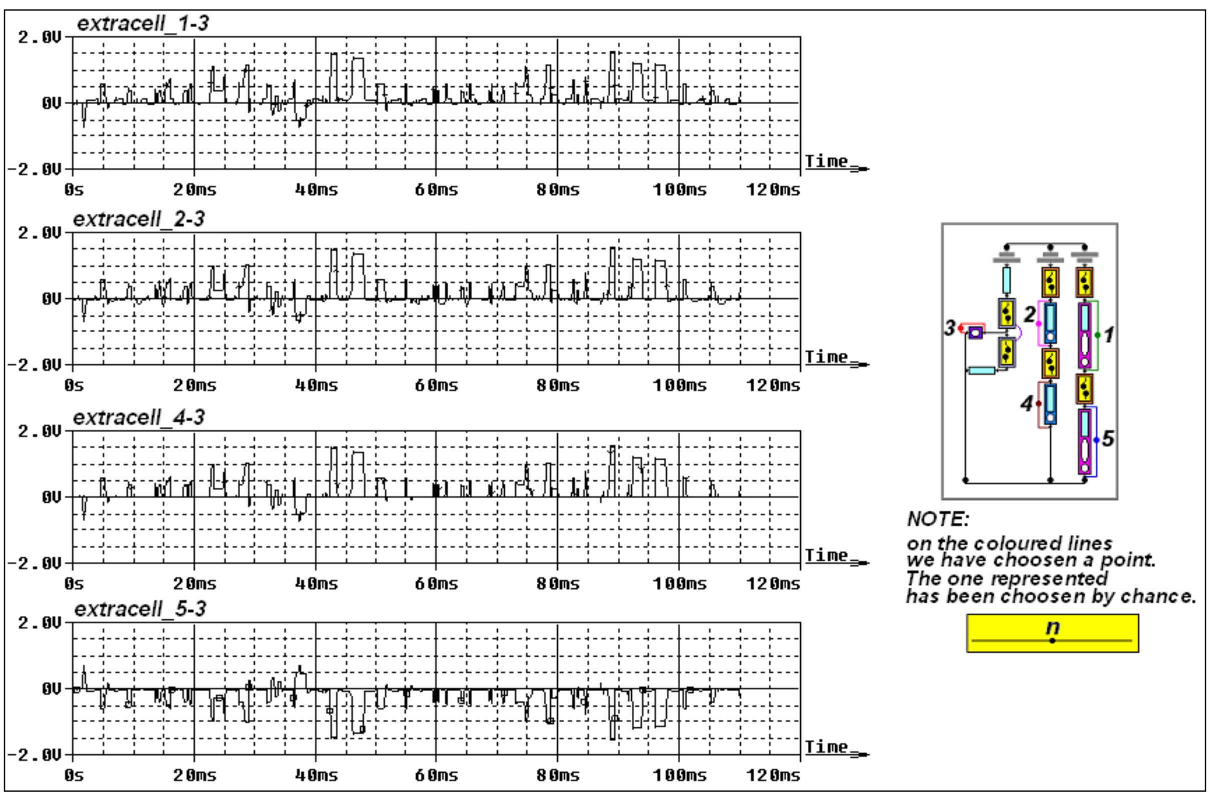

extracell_1-3
extracell_2-3
extracell_4-3
extracell_5-3
2.0V
0V
-2.0V
0s
20ms
40ms
60ms
80ms
100ms
120ms
Time
NOTE:
on the coloured lines
we have choosen a point.
The one represented
has been choosen by chance.
n

FIG. 19

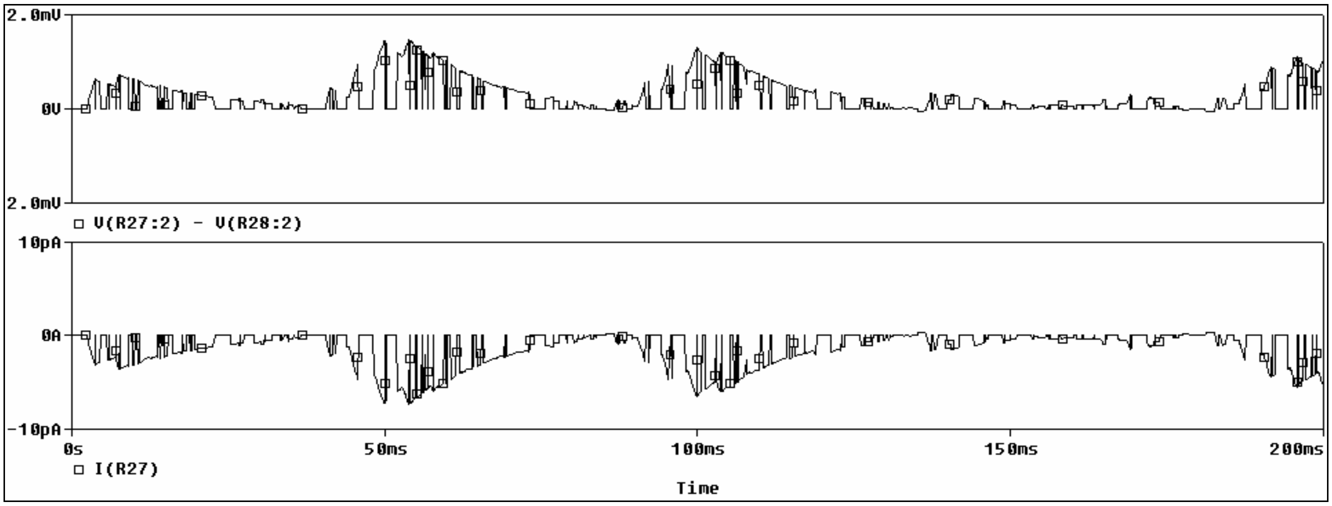

2.0mV
0V
2.0mV
V(R27:2) - V(R28:2)
10pA
0A
-10pA
0s
50ms
100ms
150ms
200ms
I(R27)
Time

FIG. 20

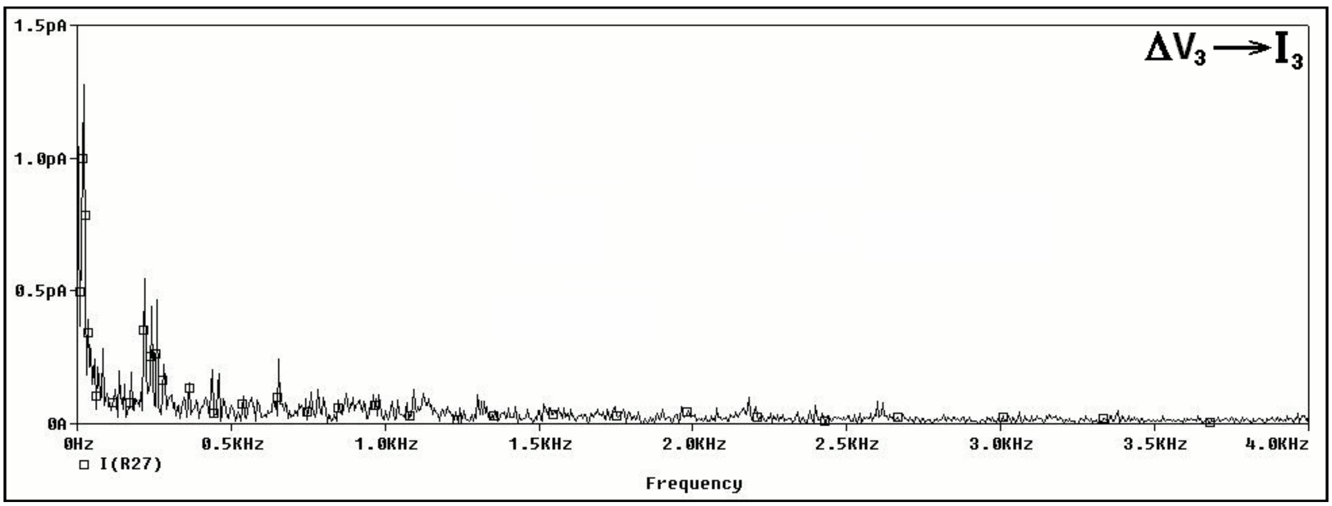

1.5pA
1.0pA
0.5pA
0A
$\Delta V_3 \longrightarrow I_3$
0Hz
0.5KHz
1.0KHz
1.5KHz
2.0KHz
2.5KHz
3.0KHz
3.5KHz
4.0KHz
I(R27)
Frequency

FIG. 21

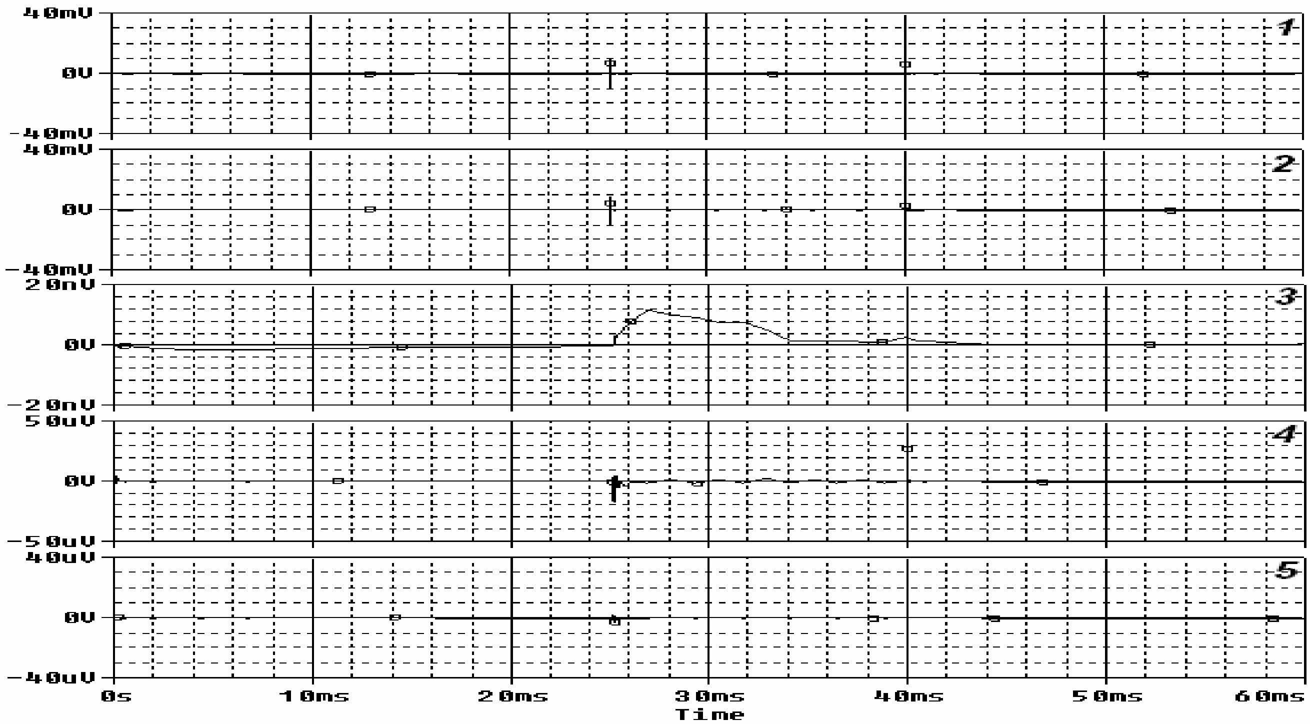


FIG. 22 - harmonics n°1:

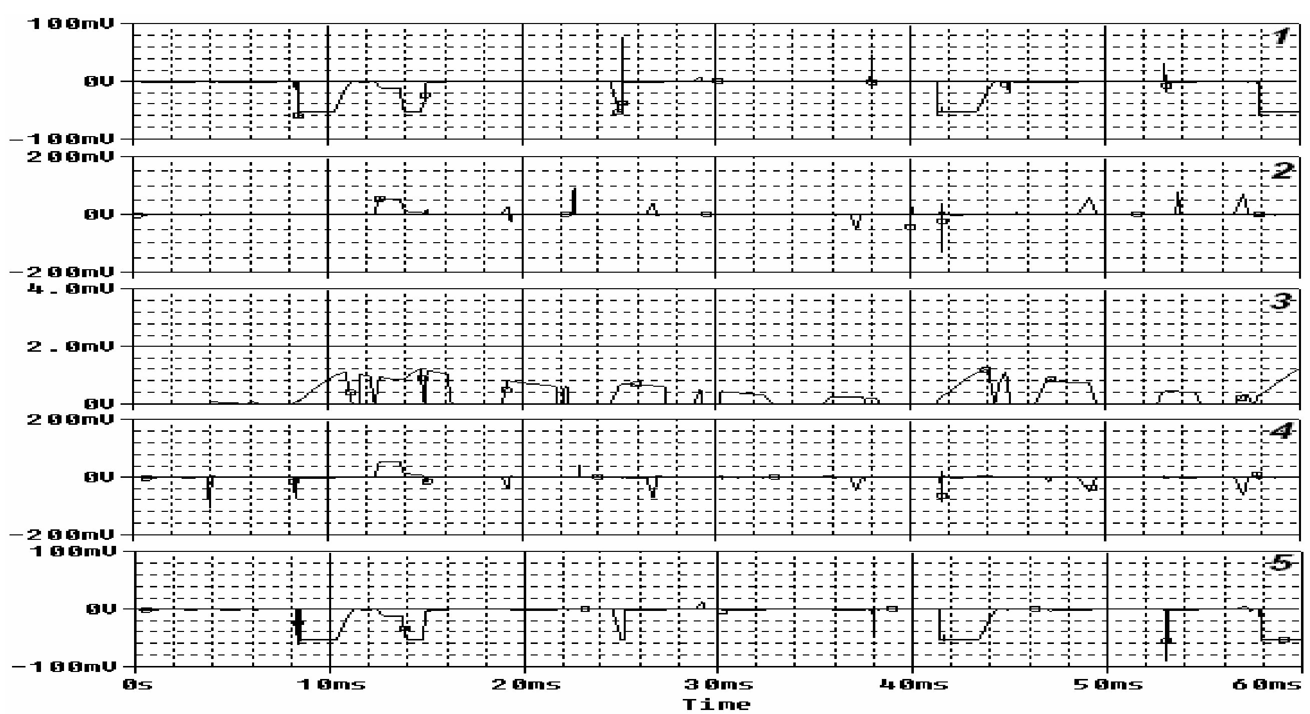


FIG. 23 - harmonics n°9

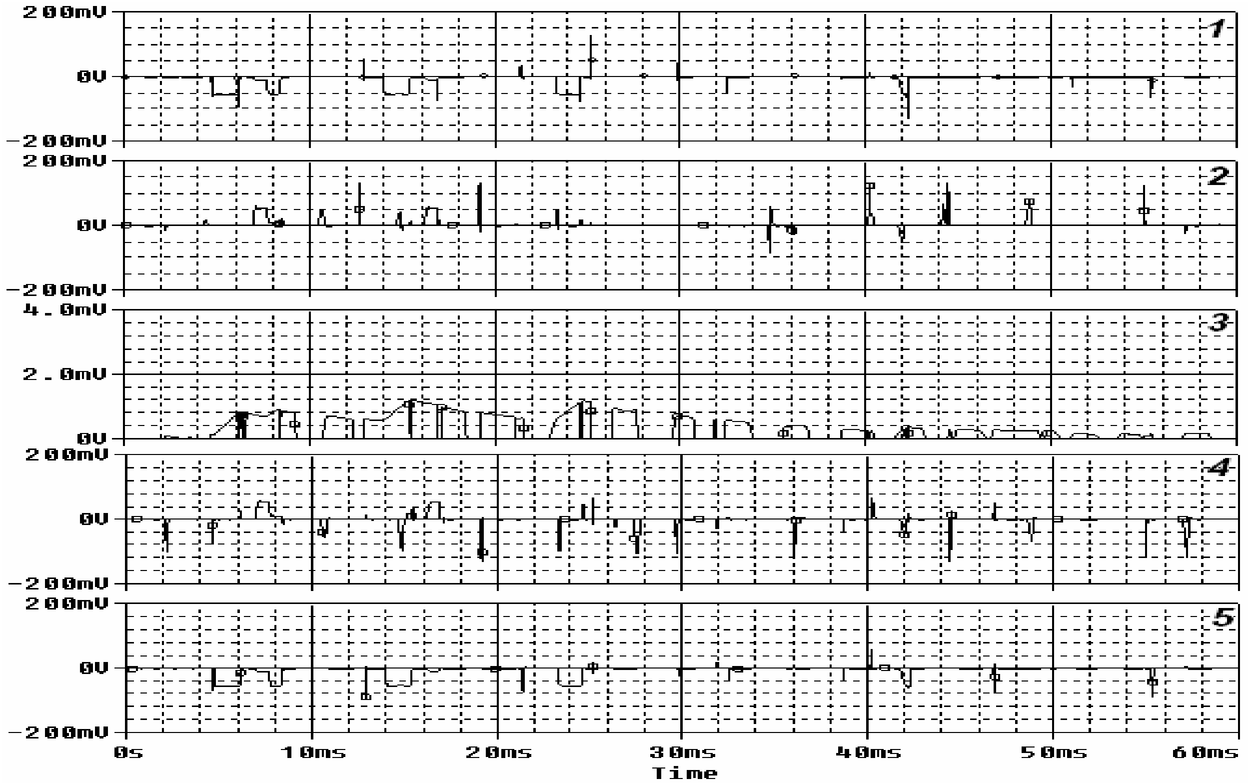


FIG. 24 - harmonics n°12

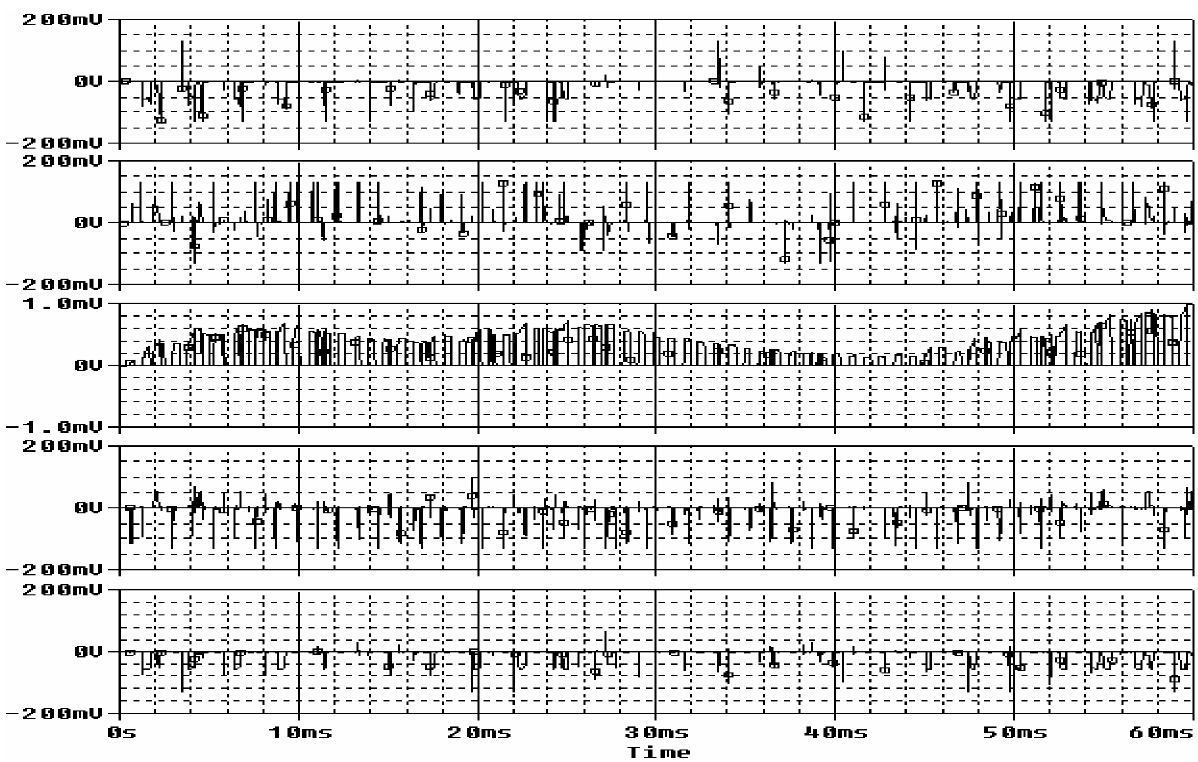


FIG. 25 - harmonics n°23

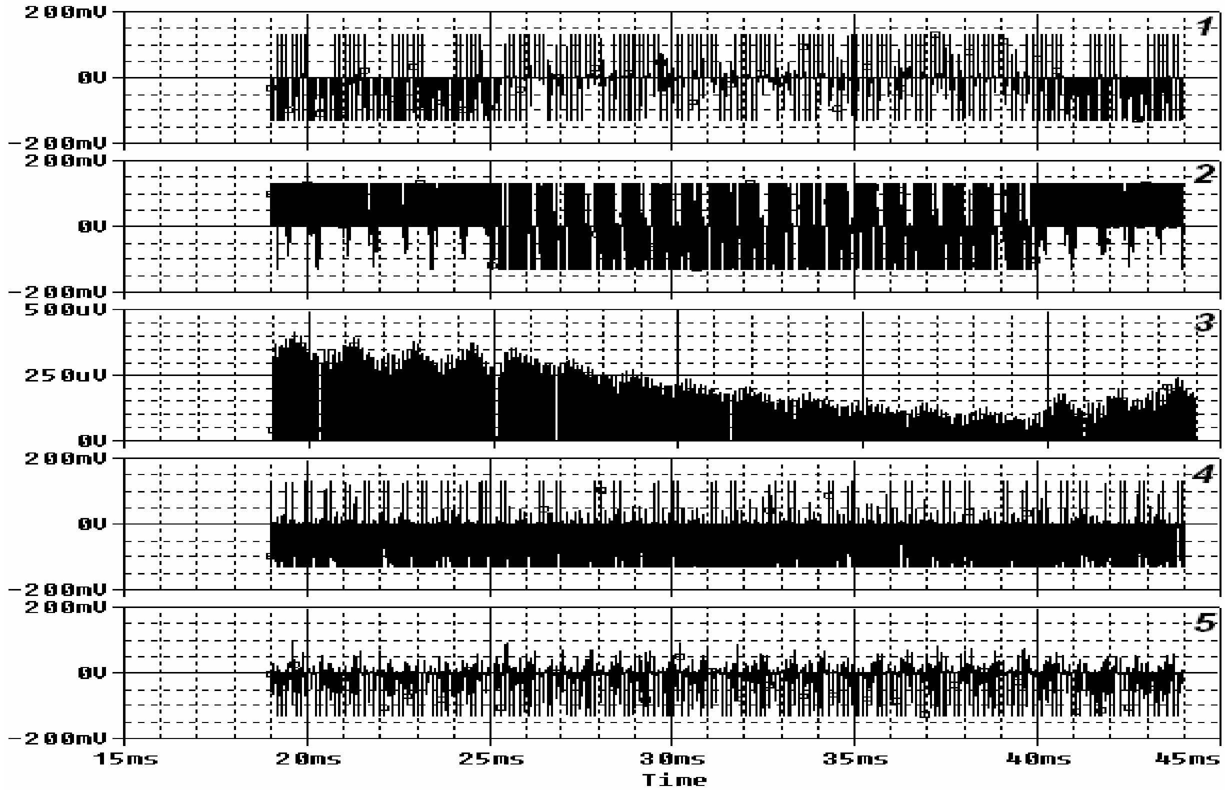
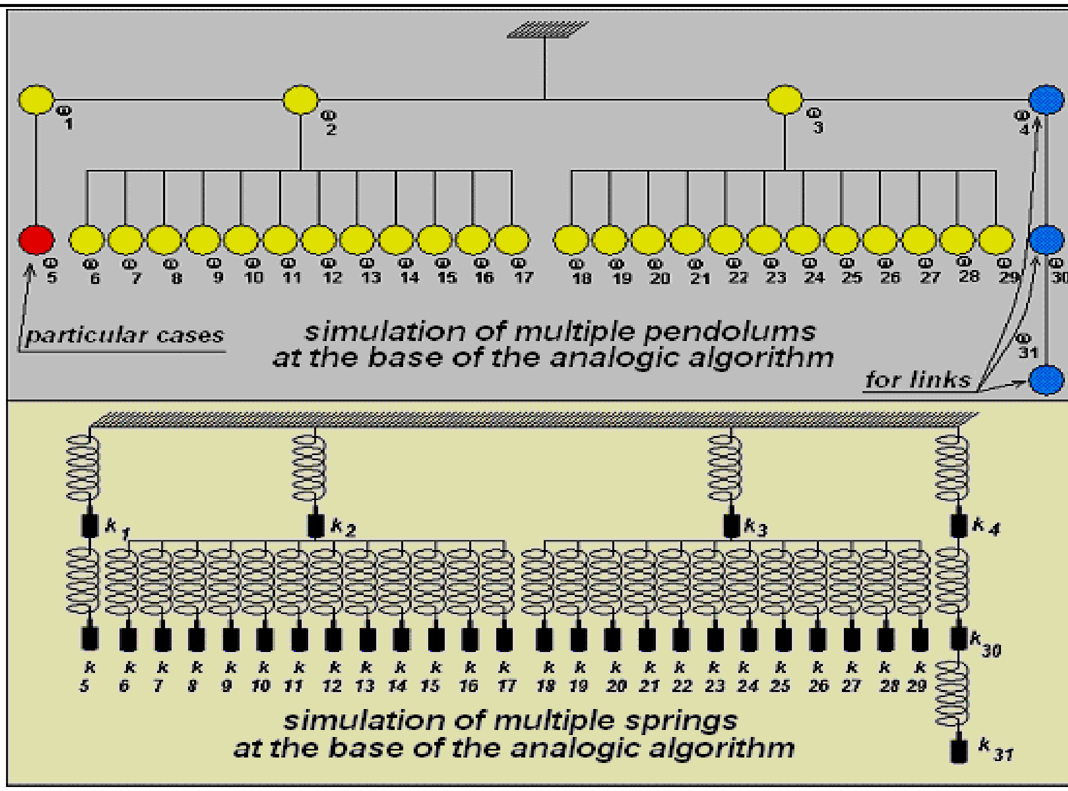


FIG. 26 - harmonics n° 96



TIMES, ACTIONS AND REACTIONS TABLE			
	$t_1 = t^*$	$\sigma_{ij} = -1$	$\varepsilon_{lm} = -1$
	$t_2 = t^* + 1$	$\sigma_{ij} = +1$ if $K_{lm}\varepsilon_{lm} > \Theta_{lm}$ $\sigma_{ij} = -1$ if $K_{lm}\varepsilon_{lm} < \Theta_{lm}$	$\varepsilon_{lm} = -1$
	$t_3 = t^* + 2$	$\sigma_{ij} = -1$	$\varepsilon_{lm} = +1$ if $H_{ij}\sigma_{ij} > \Theta_{ij}$ $\varepsilon_{lm} = -1$ if $H_{ij}\sigma_{ij} < \Theta_{ij}$
	$t_4 = t^* + 3 = t_1$	$\sigma_{ij} = -1$	$\varepsilon_{lm} = -1$

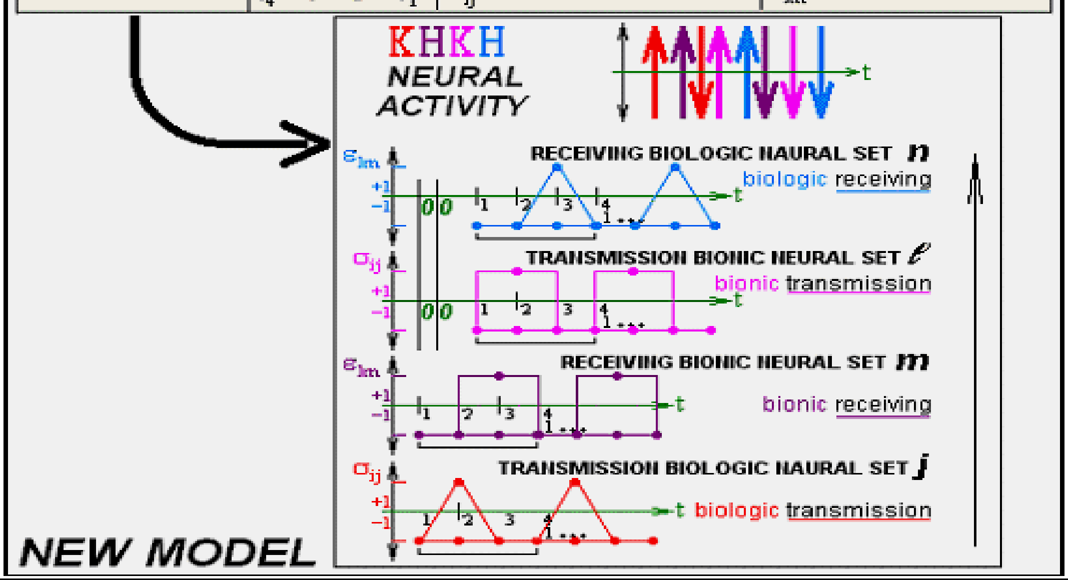


FIG. 27

The wave forms are only descriptive.

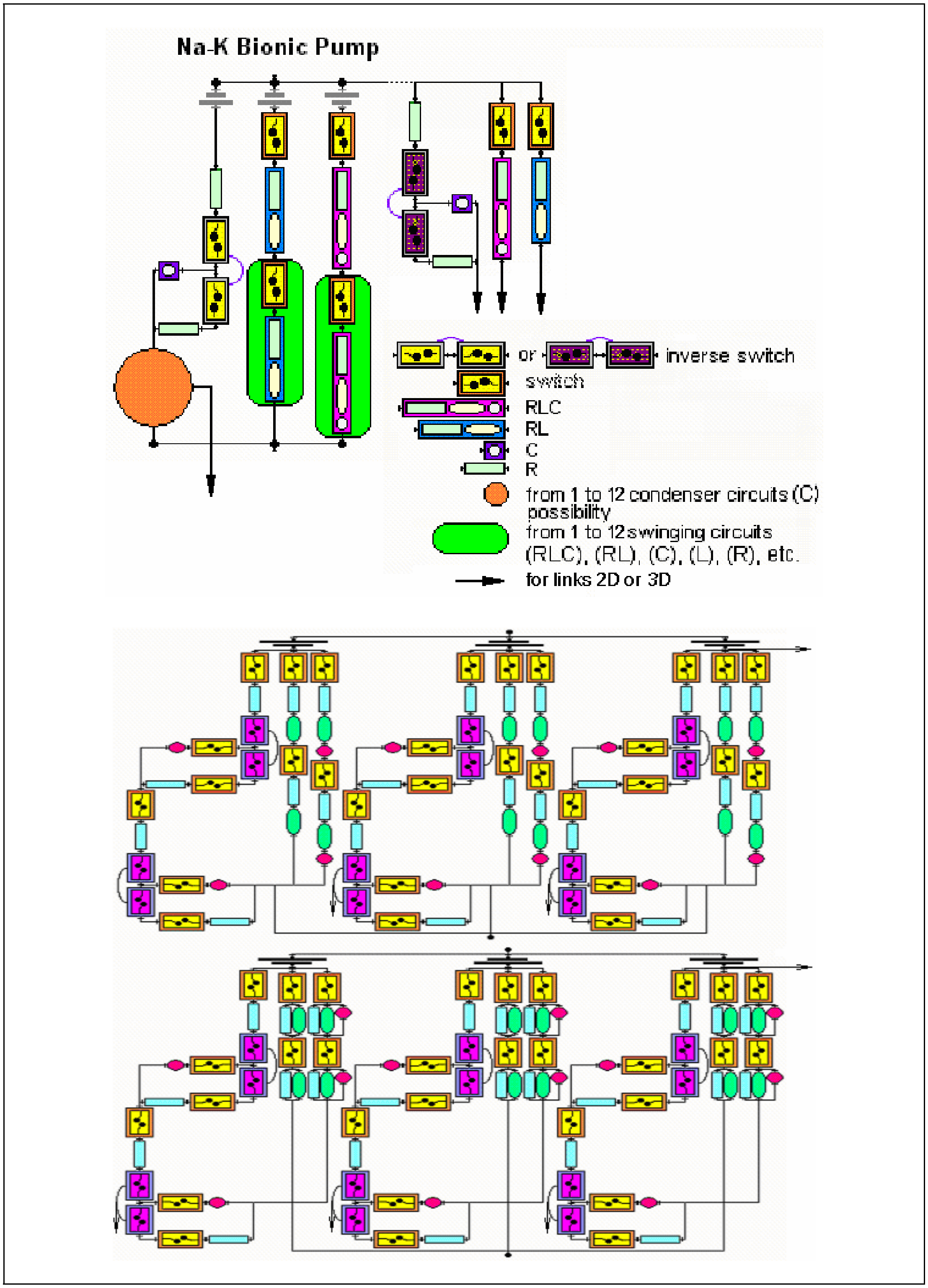


FIG. 28

Electro-informatics simulation ***last*** *Model*

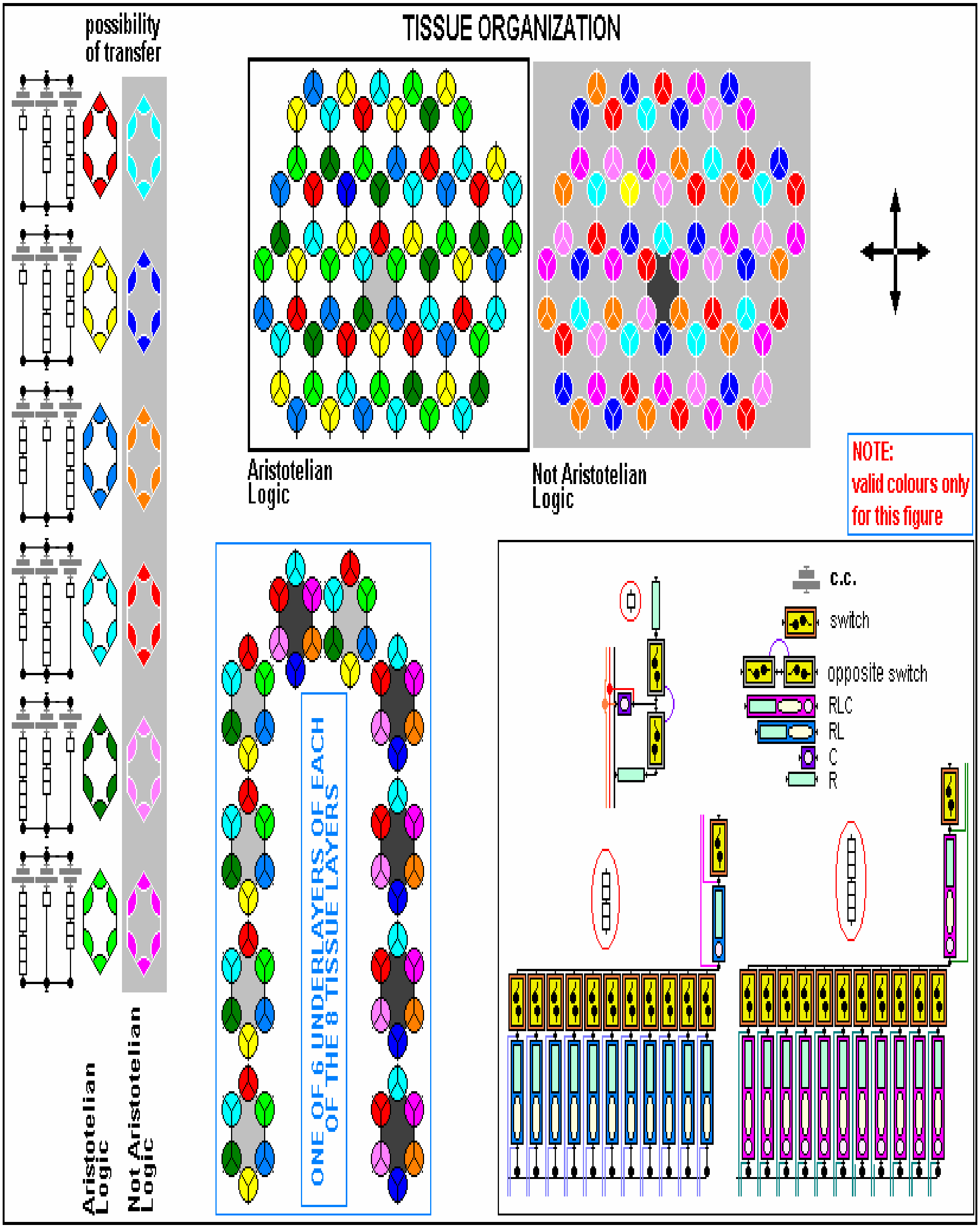

TISSUE ORGANIZATION
possibility
of transfer
Aristotelian
Logic
Not Aristotelian
Logic
Aristotelian
Logic
Not Aristotelian
Logic
NOTE:
valid colours only
for this figure
ONE OF 6 UNDERLAYERS OF EACH
OF THE 8 TISSUE LAYERS
c.c.
switch
opposite switch
RLC
RL
C
R

FIG. 29

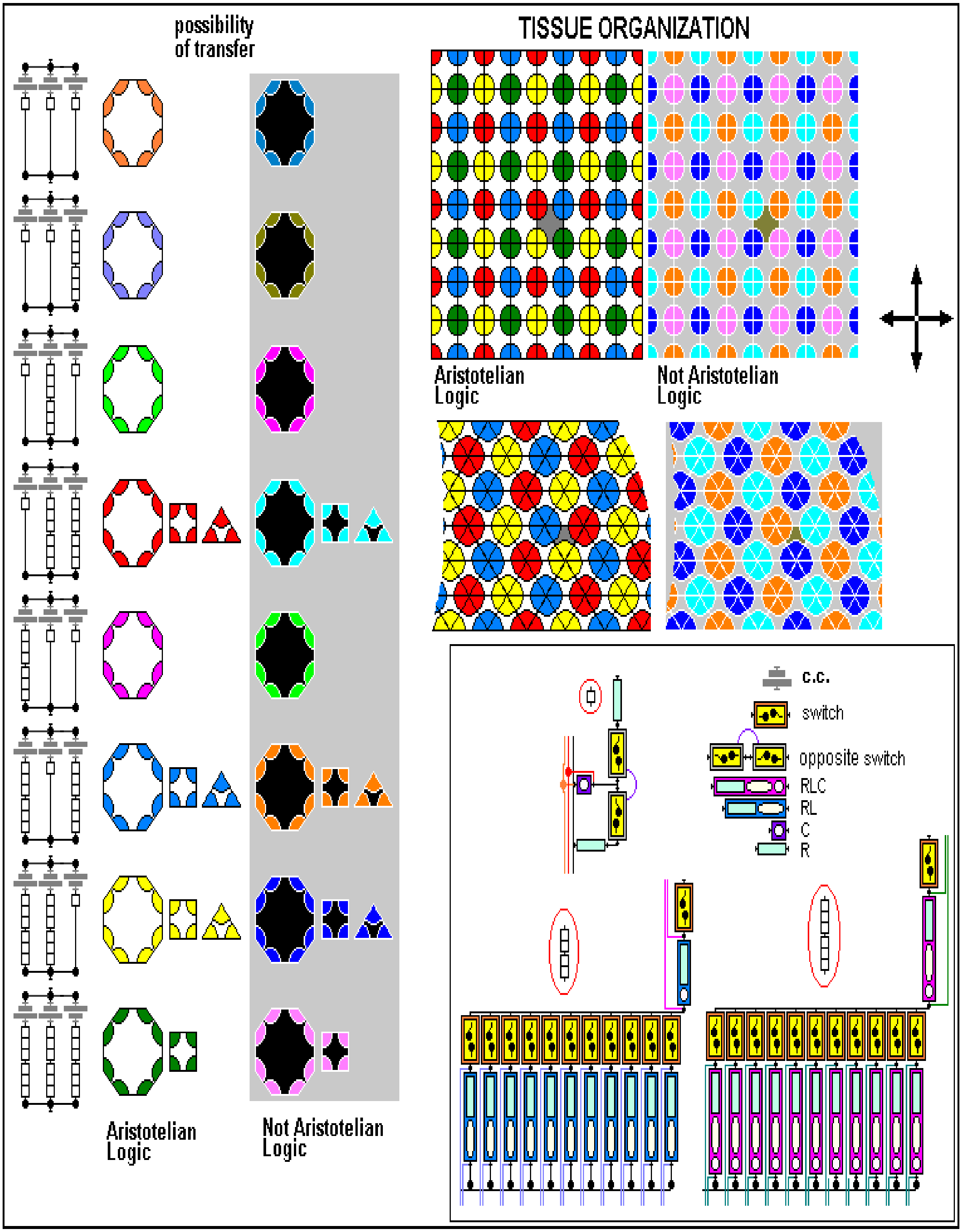

possibility
of transfer
TISSUE ORGANIZATION
Aristotelian
Logic
Not Aristotelian
Logic
c.c.
switch
opposite switch
RLC
RL
C
R
Aristotelian
Logic
Not Aristotelian
Logic

FIG. 30

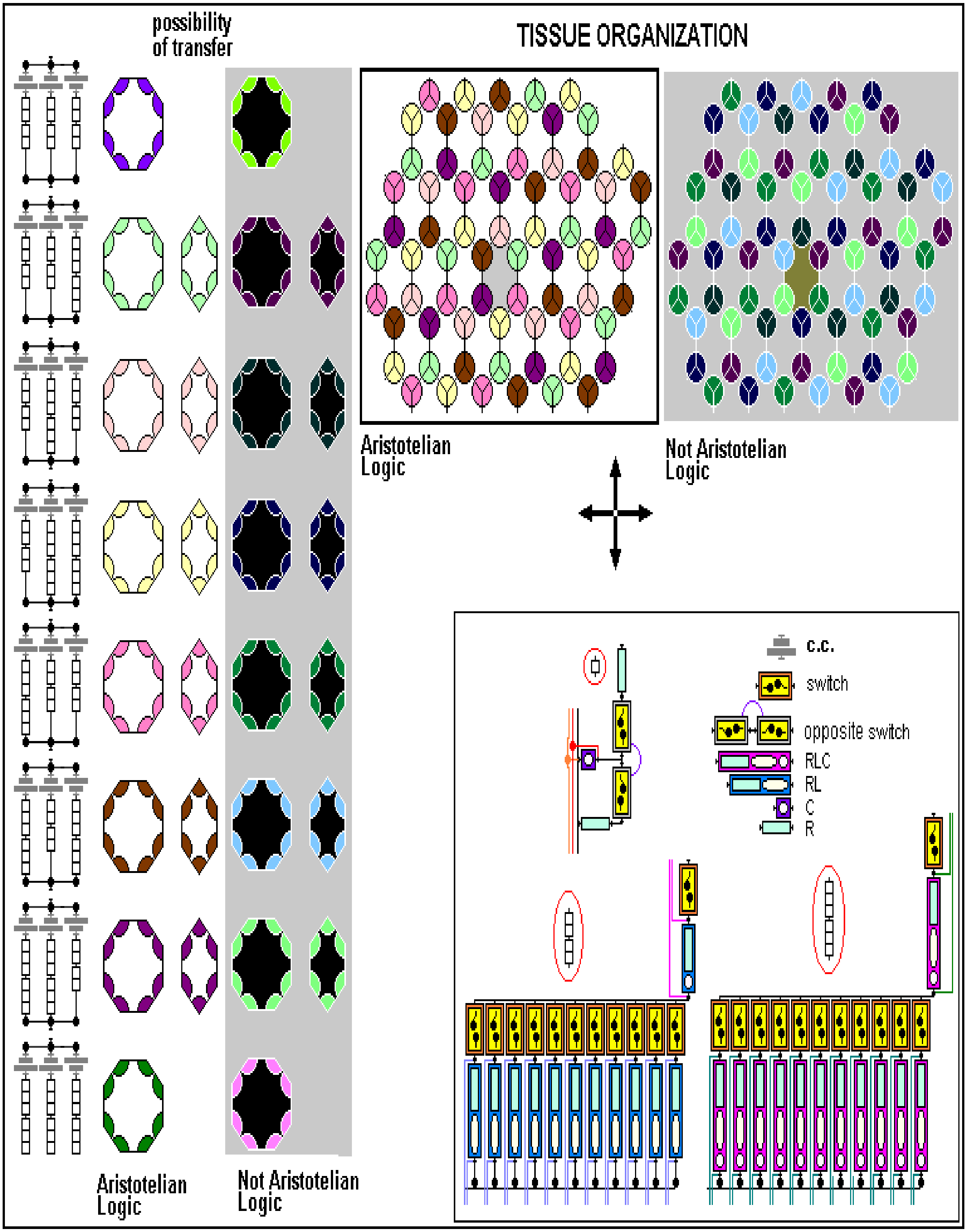

possibility
of transfer
TISSUE ORGANIZATION
Aristotelian
Logic
Not Aristotelian
Logic
c.c.
switch
opposite switch
RLC
RL
C
R
Aristotelian
Logic
Not Aristotelian
Logic

FIG. 31

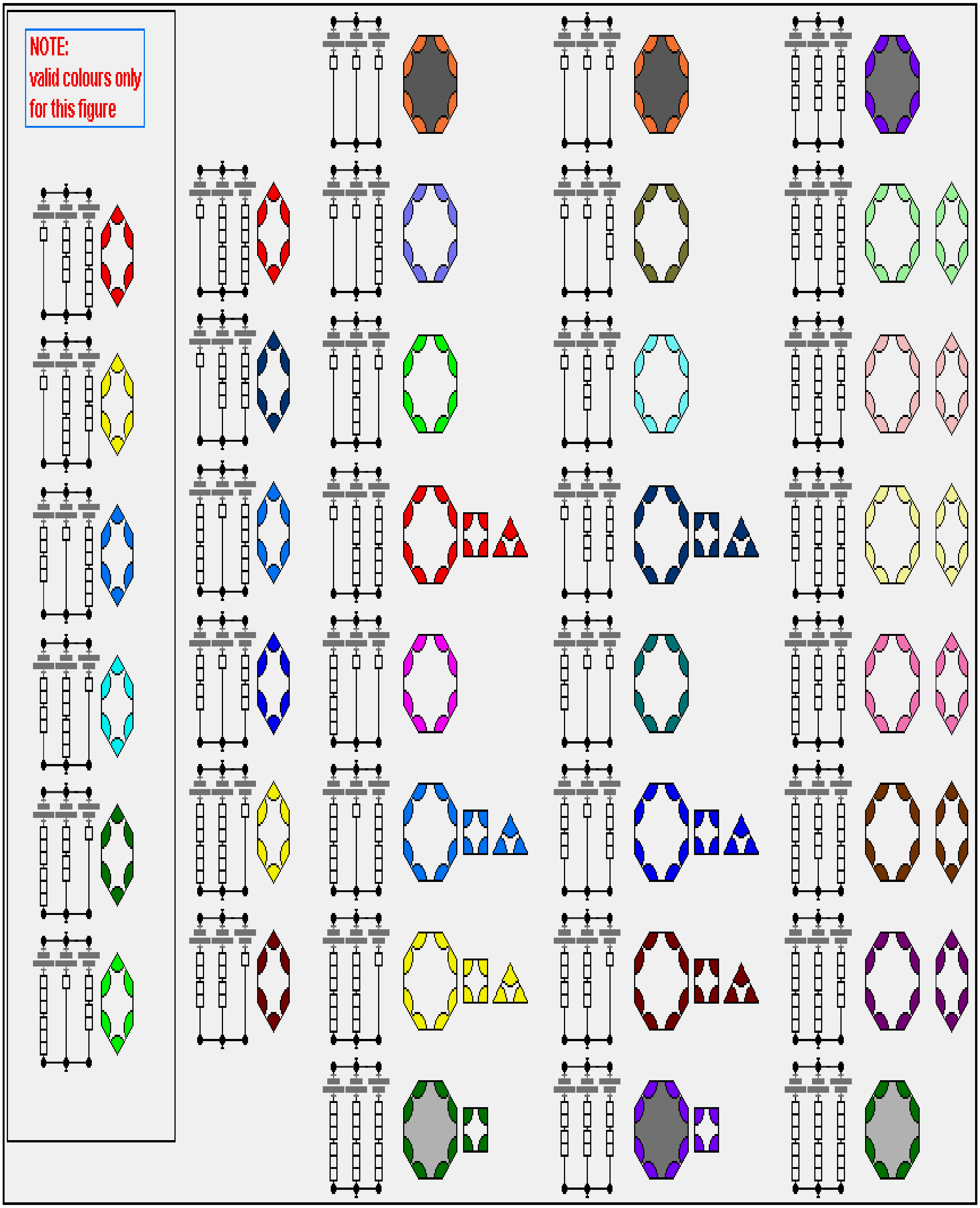
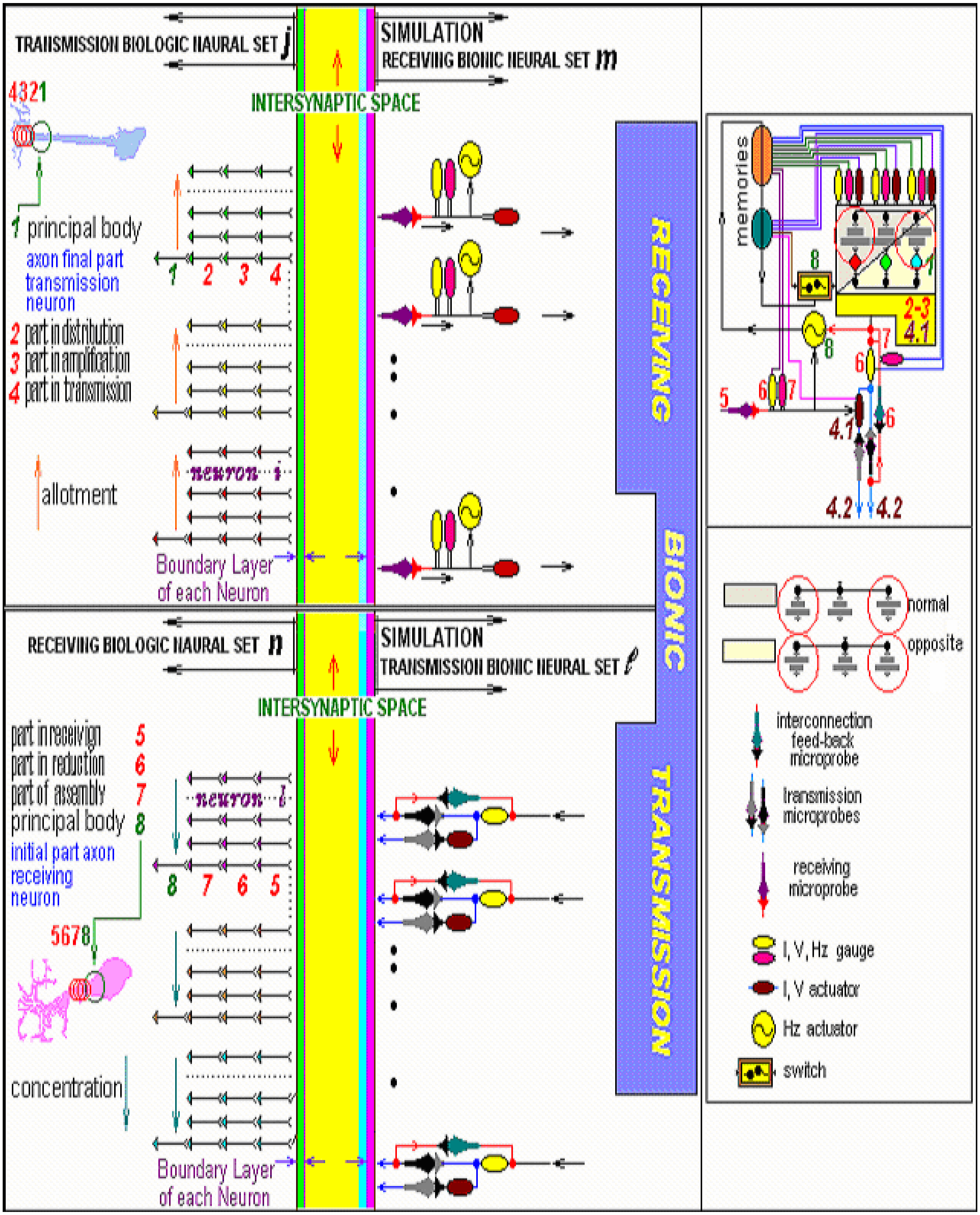


FIG. 32



TRANSMISSION BIOLOGIC NAURAL SET j
SIMULATION
RECEIVING BIONIC NEURAL SET m
INTERSYNAPTIC SPACE
4321
1 principal body
axon final part
transmission
neuron
2 part in distribution
3 part in amplification
4 part in transmission
allotment
neuron i
Boundary Layer
of each Neuron
RECEIVING
BIONIC
TRANSMISSION
memories
RECEIVING BIOLOGIC NAURAL SET n
SIMULATION
TRANSMISSION BIONIC NEURAL SET ℓ
INTERSYNAPTIC SPACE
part in receivign 5
part in reduction 6
part of assembly 7
principal body 8
initial part axon
receiving
neuron
5678
concentration
Boundary Layer
of each Neuron
normal
opposite
interconnection
feed-back
microprobe
transmission
microprobes
receiving
microprobe
I, V, Hz gauge
I, V actuator
Hz actuator
switch

FIG. 33