

Five axioms for establishing a psychology based on natural sciences for the preneuronal evolutionary phase of life

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A note on the author

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Abstract

The following article attempts to describe a system of pre-neuronal psychology that refers to unicellular life in the early period of evolution (3,500 – 1,000 million years). For this purpose, five axioms have been formulated connecting physics, chemistry and biology, entirely without considering neuronal systems.

Keywords: axioms. pre-neuronal psychology, early evolution

Five axioms for establishing a psychology based on natural sciences for the pre-neuronal evolutionary phase of life

Are the currently known laws of physics sufficient to establish psychology as a natural science or is psychology a separate science with its own system of axioms? Associated with this issue is an additional problem: can subjects such as philosophy and the social sciences (or “soft sciences” as they are called) be explained by physics. For more than 20 years at the now famous Tucson conferences “Toward a Science of Consciousness”, the Australian philosopher David Chalmers has also been posing a question to this effect: Why do we actually have an inner experience, why are we not simply machines instead (Chalmers 1996, 2014)? Why do we have consciousness at all? Can we not largely comprehend the behaviour of living organisms with the laws of natural sciences? Is consciousness a superfluous epiphenomenon?

Physical movement and mental energy

Let us consider a living system (symbolized by a circle), which for the sake of simplicity moves through space at a uniform speed (cf. Fig. 1), the movement of this system is described fully in physical terms by the simple formula

$$v = \frac{s}{t} \quad \text{where } s = s_1 + s_2 \quad (1)$$

Insert Figure 1 here

Psychologically, considered from the position of the inner experience, this description is not sufficient. It does not in fact distinguish between two fundamentally relevant states:

Does the system S move

1. away from a negatively experienced point in space, P_1

or

2. towards a positively experienced point in space, P_2 ?

Viewed in physical terms, the two distances s_1 and s_2 become relevant, viewed in psychological terms, an inner state presents itself as either a positive $E+$ or negative $E-$ basic emotion. There is now a functional connection between the basic mental emotions and the paths s_1 and s_2 .

$$E- = f(s_1) \quad (2)$$

The negative basic emotion, $E-$, decreases steadily as the distance s_1 increases.

$$E+ = f(s_2) \quad (3)$$

The positive basic emotion, $E+$, increases steadily with decreasing distance of s_2 . This state of affairs gives us the opportunity to make fundamental considerations on the nature of mental energy.

Mental energy and physical evolution

Since Freud, it has been customary to assume a single mental energy that may appear in a wide range of qualities of basic emotions. Freud was fascinated by the physical energy model and the law of energy conservation (Freud 1999a). In his earlier writings he called for

a model that also considered the conservation of mental energy. he calls it libido and initially uses it to refer exclusively to positive life energy (the desire for food and sexuality).

It is only in the later writings that he fundamentally adds a negative mental energy, as he emphasizes in the "Outline of Psychoanalysis" (Freud 1999b), which unfortunately has not found a scientific name. This is determined firstly by the powers of aggression and destruction, and secondly by the experience of fear with the tendency towards flight. According to Freud, both basic forces are of a biological nature and, in his topological model, are allocated to the id (cf. Fig. 2).

Insert Figure 2 here

The classic energy model of Sigmund Freud corresponds astonishingly precisely with the modern neurophysical basic model of the emotions, as has been formulated by Damasio (1999, 2010), Panksepp (1998), Edelman (2004) and Solms (2004). This model has to be regarded as scientifically confirmed. It is based on new research into the structure and chemical function of the brain, and in particular of the brain stem.

Insert Table 1 here

The emotions listed in Table 1 form the basic structure of the self. Panksepp coined the expression "Simply Egolike Self-Formations" for this. According to modern topology, they are constituent parts of the proto-self and hence of the primary consciousness (Damasio 1999, 2010), where they represent the basal qualities of experience and not yet qualities of conscious experience in the narrower sense. However, their relation to the secondary consciousness (speech-based, imagination-associated, self-reflected consciousness is not adequately clarified.

The basic mental emotions evidently have the status of forces or energies. However, physics only recognizes four basic forces: gravity, H , strong nuclear force, g , weak nuclear force, W and Z , and electromagnetic force, γ . According to the ideas of modern physics, these forces originally unite to form one single energy in the energy of the big bang and are then only gradually separating during the course of the evolution of the universe. This theory is called the Grand Unified Theory (GUT) after Hawking in 1980.

Initially, the strong nuclear force, g , separates from the unified primal energy and binds the quarks, q , together. This process gives rise to the elementary particles of protons, p , and neutrons, n . They in turn are bonded by the next force to split off, the weak nuclear force (Z and W particles) to form the nuclei of the atoms. Finally, the electromagnetic force, γ , bonds the electrons into a shell around the nucleus of the atom. It is also the force that combines the atoms into molecules and forms the basis of the material world in all its chemical diversity.

Insert Figure 3 here

One particular phenomenon is that the electromagnetic force actually consists of the indissoluble interconnection of two forces, namely the electric and the magnetic. Every electrical change in potential difference, i.e. every form of moving electrical energy builds up a magnetic field. Conversely, the movement of a magnetic field gives rise to an electric current. While all other forces of nature have separated from each other during the course of the evolution of the universe, electric and magnetic forces have remained connected with one another. Why?

Electromagnetic force also has another special role. According to everything that we know, it is the effective force of emotional experience and consciousness. Every form of emotion, perception and action is accompanied by a change in potential difference within the

nervous system. Experiencing and consciousness are supported by a constant electromagnetic flow. Extinguishing the electromagnetic flow results in the death of consciousness and experience and is the decisive scientific tool for the diagnosis of death.

One of the greatest puzzles of modern consciousness psychology is how the simple electromagnetic current that is present throughout the body is able to produce the complicated diversity of experience (qualia problem). This brings us back to Chalmers' difficult question: Why do we have experience at all?

I wish to combine the two questions of

a) Why have electric and magnetic force not separated during the course of evolution?

and

b) Why do we have emotional experience at all instead of being automatons?

with one another and then propose the following hypothesis: Electric and magnetic force have indeed separated from one another during the course of evolution. This separation is only not observable in the "outer" ("objective") world. It is not observable because it actually provides the basis for the observation itself (in general the emotional experience). The separation of electric and magnetic energy gives rise to a mental inner world with its very own set of natural laws. This simultaneously provides the connection between psychology and natural sciences and thus extends the latter by a new perspective (the inner nature). The first axiom for the inner nature states:

Axiom 1

The separation of electric and magnetic force fundamentally gives rise to

- a) an internal experience of tension
- b) an external experience of space

The inner experience of tension has the character of subjectivity. It represents itself as a single point in the experienced space, forms a psychological singularity. The experienced space, in contrast, consists of an infinite number of mutually equivalent points, of an infinite diversity.

Axiom 2

The experienced tension is divided into positively experienced tension (E+) and negatively experienced tension (E-).

The two variables E+ and E- have already been explained in the text and are represented schematically in Figure 1 and Table 1.

Axiom 3

The space experienced is divided into a movement space and an object space.

We shall return to this fact later when we deal with the function of the cell membrane for the early psyche. However, readers can already gain a visual experience of the postulated property of space-consciousness for themselves in an experiment. Rubin's famous optical illusion is illustrated for this purpose (cf. Fig. 4).

Insert Figure 4 here

The viewer can either see two black faces protruding from the side into the picture or one finely designed white vase located in the middle. However, both objects can never be perceived simultaneously. When the viewer sees the faces, the vase immediately loses its concrete character and automatically becomes the space experienced. When the viewer sees the vase, the two faces similarly automatically become a uniform dark space.

This experiment once again shows us the fundamentally dual differentiation of emotional experiences, as formulated in Axiom 1. This dual nature is the decisive characteristic of the natural science of the inner self.

The image of Rubin's illusion is based on a physically founded stimulating event that does not change during observation. Only during the psychological experience does the physically well-defined stimulus split into two (dual) states of experience that can be strictly separated from one another in terms of consciousness.

Until now we have worked on the basis of the biological model that a living organism moves within a far space. This model represents the already relatively late evolutionary stage of multicellular organisms that in psychological terms have the capability of perception at a distance (seeing and hearing). We have to further simplify the base model and descend to the biological status of the unicellular organisms if we wish to explain the basic attributes of the psyche from its evolutionary beginnings.

Early psyche and early membrane functions of the original cell

During a long period of evolution, living unicellular organisms were protoplasm surrounded by a membrane. The structure of the simple unicellular organisms dominates the evolution of life for a period of approximately 2.5×10^9 years (cf. Fig. 5). Only very little is known of their existence from fossilized impressions in rocks.

Insert Figure 5 here

To date, it has only been possible to systematically investigate behaviour and irritability on more complex unicellular organisms that are not older than roughly one thousand million years (cf. Fig. 5). In these animals we have already been able to observe mechanical, thermal, chemical and electrical irritability, which justifies the assumption that forms of experience of (tactile) objectivity, heat and taste can already be realized at the level of the simple cell. This is connected with the fact that these animals are capable of independent movement (cf. Fig. 6).

Insert Figure 6 here

According to Axiom 1, the experienced space must be restricted to the individual cell for early living organisms in psychological terms. What is experienced is the near space limited by the body. The experience of physical tension, which, according to Axiom 1, is in fact fundamentally separated from the experience of space, is restricted to the tension of the membrane.

There is a close connection in the cell membrane between electromagnetic and mechanical tension. Both forms of tension can be raised or lowered locally. Against this background, we can study the important connection between motion and perception on the cell membrane.

Perception and motion are fundamental for the biological basic function of metabolism. In order to maintain life, biological units have to absorb energy from the outside. This takes place in the form of light and heat (electromagnetic radiation) or through the intake of organic substances (fats, carbohydrates, proteins), which are converted by chemical reactions in the

cell and thus generate physical energy. The organic chemical reactions of energy production generate substances which the cell body has to emit again.

The intake and output of substances (nutrition and excretion) are regulated psychologically by the fundamental mechanism of linking perception and motion. This takes place via the change in membrane tension. Let us first consider perception at the early evolutionary life stage of the unicellular organisms. Of particular significance for the metabolism is chemical perception.

Chemical perception functions according to the key and keyhole principle. Molecules that coincide with the cell from outside are incorporated into the corresponding spatial gaps of the membrane molecules. As a result, the local potential difference of the membrane changes (cf. Fig. 7).

Insert Figure 7 here

The change in potential difference is firstly associated with a local perception. Instead of x, for example, the taste of sweetness arises. This situation takes place in accordance with Axiom 1, with a point in space (here the body space) fundamentally being allocated to quality of experience by "internal splitting" of electric and magnetic force. At the same time, the change in the potential difference leads to stereochemical changes of the molecule, which are also expressed in a change in the mechanical tension.

The membrane expands or constricts locally. This causes the transport of matter into or out of the cell. In this process, the perception quality (e.g. sweet versus bitter) determines the direction of transport for the corresponding substance. The process takes place through vesicle formation (cf. Fig. 8). Here too, in comparison with the basic model in Fig. 1, the quality of experience serves to determine the direction of motion.

Insert Figure 8 here

We assume that the psychological tendency for the membrane to open or close is connected with the experiencing of the basic emotions (cf. Fig. 2 and Table 1) and formulate an additional axiom.

Axiom 4

The basic emotions E+ and E- are formed by the summation of local perception qualities as an expression of the overall sensory stimulation.

This confirms the view of the early holistic and gestalt psychology of the Leipzig school. The psyche as a whole can be divided into sections. All combinations of perception ("aggregates" after Wundt) have a "holistic" overall experience quality (Volkelt 1967) and this corresponds to the respective emotion (Sander 1967).

In accordance with what has been said previously, we can state: psychological experience is formed by internal splitting of the electromagnetic force into experienced space and experienced tension. In the experienced tension, a distinction can be made between two basic mental emotions desire, E+, and aversion, E-, which cause a mental direction of motion within the experienced far space ("towards something" or "away from something"). Related to the space of the individual cell limited by a membrane (body space), the positive or negative energy determines the directions of movement "into the body" or "out of the body", i.e. "opening" or "closing" in the widest sense.

Chemical processes in accordance with the key-keyhole principle cause local changes in tension and hence firstly local perception qualities and secondly mechanical changes in tension within the membrane. The corresponding substances become tied up in vesicles, which take over the transport. Biologically, the direction of this is decisive: into the cell (nutrition) or out of the cell (excretion). The direction is predetermined by the quality of mental perception.

We now confront the questions of how the local experience qualities arise. This problem is generally designated the qualia problem.

The qualia problem and a possible solution

If the theory of the internal electromagnetic splitting is to be valid, there also has to be an electromagnetic model for the solution of the qualia problem. Let us consider the different experience qualities of the various sensory perceptions. Table 2 provides an overview.

Insert Table 2 here

We wish to avoid an extensive discussion of the psychology of experience qualities in this connection because the topic is sufficiently demanding for a separate fundamental examination. In this case an overview is sufficient. What is of importance is the relation to the theory of quantum numbers.

The least degree of clarity prevails for the qualia relating to the sense of smell. From time to time, the characteristics of "spicy" and "flowery" are included among the basic qualities. However, these two categories can be derived from combinations with other qualities of the senses (e.g. "flowery" = "sweet" + "fruity"). In any case, it is clear that there are specific receptors for the perception of smell.

Despite the subjectivity of sensory experience, it is noticeable that the mechanical and thermal senses each encompass two primary states, the chemical senses four, the perception at a distance eight, with the eighth level (an octave) representing a closed unit in terms of experience. These figures are very reminiscent of the chemical quantum numbers in the structure of matter: two, eight, and four as the mid-point between two and eight.

As is generally known, the maximum number of electrons, Q , which can occupy the n^{th} orbit of the atomic shell is calculated using the formula

$$Q = 2n^2 \quad (4)$$

Q = maximum number of electrons

n = main quantum number, designating the number of orbits

The quantum numbers denote the different energy levels of electron orbits at a certain spatial distance from the nucleus. In the first orbit, two electrons revolve around the atomic nucleus, in the next eight, and so on. The energy level of four electrons in the second orbit is an excellent condition in that it allows atoms to bond to themselves (chain formation of carbon). This raises the proposal that quantum numbers not only determine the structure of the material world but also that of the mental world. Quantum numbers are also qualia numbers.

Chemical chain formation is the basis for the structure of organic molecules, i.e. the chemistry of life. The spatial and energetic distribution of the electrons in the outer sphere of such macromolecules could be quantized in just the same way as the spatial distribution of the electrons' energy in the atomic shell. A fact such as this would provide a simple way of explaining the key-keyhole principle of perception: the spatial redistribution of electronic energy in the stereochemical bonding of organic macromolecules takes place in accordance with the rules of quantum physics. The different energy levels can be expressed in quantum

numbers. These states correspond to the familiar perception qualities (cf. Table 2). This enables us to formulate an additional axiom:

Axiom 5

The qualities of mental perception (qualia) arise due to different quantum levels of energy distribution in biochemical macromolecules.

This assumption of Axiom 5 is attractive because the electrical transfer in simple and central nervous systems similarly takes place via neuro-transmitters in accordance with the key-keyhole principle. At the same time, the assumption explains why electromagnetic energy (light, heat) striking the organism from the outside can be converted into mental experience. This energy also changes the quantum structure in the periphery of the macromolecule. The key-keyhole effect means that a redistribution of the energy takes place in the “electron shells” of the two organic substances involved. A common, overriding new electron distribution forms or even a new stereochemical unity and structure.

This redistribution obviously follows the quantum numbers, i.e. it is connected with new excited states of the electrons. What could be more obvious than to directly connect these excited states with the qualities of psychological experience? We may also formulate that the qualitatively different states of sensory experiences correspond to the different excited states of the electron distribution in macromolecules, which very generally follow the quantum laws of energy distribution for electrons in nature.

If Axiom 5 can claim any validity, the qualia of the mental experience form a series with the qualities of the elements of matter. Via the common principle of electronic energy distribution, a simple series arises that leads from the qualities of matter to the qualities of experience in accordance with a general energy law of nature. Matter and experience can be understood as intervals on a single scale, using the same quantum numbers (cf. Fig. 9).

Insert Figure 9 here

In physical terms, on the basis of Axiom 5, there is no principal difference between matter and mental experience. The psyche can thus be understood as the evolution of matter.

Outlook on the evolution of neurons and nervous systems

It is noticeably that the fundamental mental functions are not linked to neurons or nervous systems. That leads us to the question of how nervous systems develop and what expansion they bring for psychological experience.

The unicellular organisms lose their diversified psychological potency and transfer it to specialized cells, the neurons. This change in function is one of the greatest secrets of evolution. How do the specialized neurons succeed in producing the entire spectrum of mental experience, which the single cell can generate with its membrane, as a special cell, as it were, by neurological means? The following questions arise in particular:

How can neurons, which in principle have a uniform structure, generate differentiated perceptions?

How can multicellular organisms with the aid of neurons produce uniform psychological basic states (emotions) if the latter were previously a function of the membrane of the single cell in evolutionary terms?

Answering these questions is so difficult that it cannot be managed by preneuronal psychology. The curious fact above all is that current psychology only begins with the analysis of neuronal systems. This of course means that the evolution of the psyche of the single cell to the psyche of cell systems or multicellular organisms is entirely unknown.

I assume that the question that has remained unanswered in biological terms of how the multicellular organisms evolve is ultimately connected with the question of why neurons have developed as special carrier cells of the psyche and what role they assume in connection with the formation of cell systems. It is the question of psychological evolution of ganglia and nervous systems. It is not at all possible to understand nervous systems as transporters of mental experience and of processes of consciousness without the evolutionary connection with the mentally functional potency of unicellular organisms. In other words, the transformation from preneuronal to neurological psychology has hitherto remained entirely unexplained.

The aim of this essay has been to clarify the principles of mental experience according to natural science from the very beginnings. The subsequent question of how nervous systems represent psyche is readdressed under the aspect of evolution. We can assume that its evolution has taken roughly three thousand million years. This fact alone already shows what a huge task nature had to solve in achieving psychological functions through complex cellular systems. The solution was accomplished with the invention of the neuron as a specialized transport cell for matters of the psyche. How neurons manage to transfer and represent perceptions, emotions and actions to cellular systems is a question that requires a separate fundamental discussion commensurate with its complexity.

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Becksche Verlagsbuchhandlung.

Tables

Table 1

System of the basic emotions after Solms (2004)

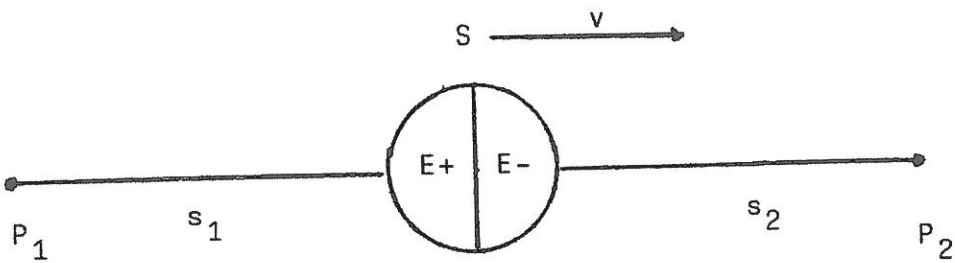
Behaviour system	Basic emotion	Mental energy
Search system	General desire	E+
	Special desire	
Aggression	Rage	E-
	Annoyance	
Flight system	Anxiety through fear	
	Anxiety through panic	

Table 2

The experience qualities of sensory perception

Short-range senses	Qualia	Qualia number
mechanical	hard, soft	2
thermal	warm, cold	2
chemical		
a) gustatory	sweet, sour, salty, bitter	4
b) olfactory	fruity, resinous putrid, burnt	4
Long-range senses		
acoustic	octave of musical scale: do, re, mi, fa, sol, la, ti, do	8
optical	colour scale: black, red, orange, yellow, green, blue, violet, white	8

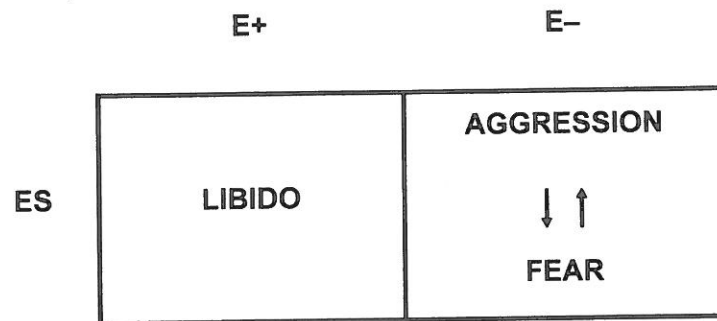
Figures



Note: The symbols are explained in the text.

Figure 1: Physical movement and basic psychological emotions

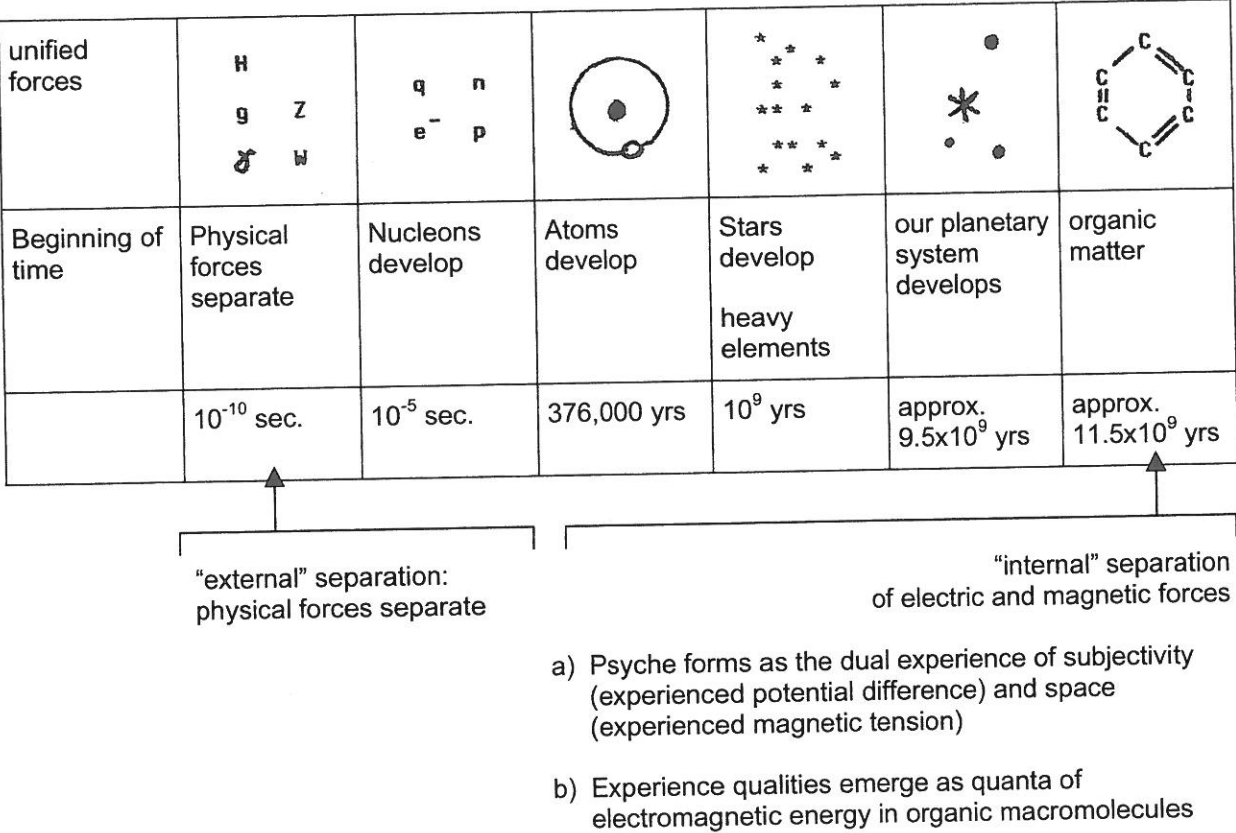
Figures



Note: E+ and E- symbolize basic psychological emotions.

Figure 2: Model of the basic emotions after Freud

Figure



Note: The symbols are explained in the text

Figure 3: Classification of psychological evolution within physical evolution

Figure

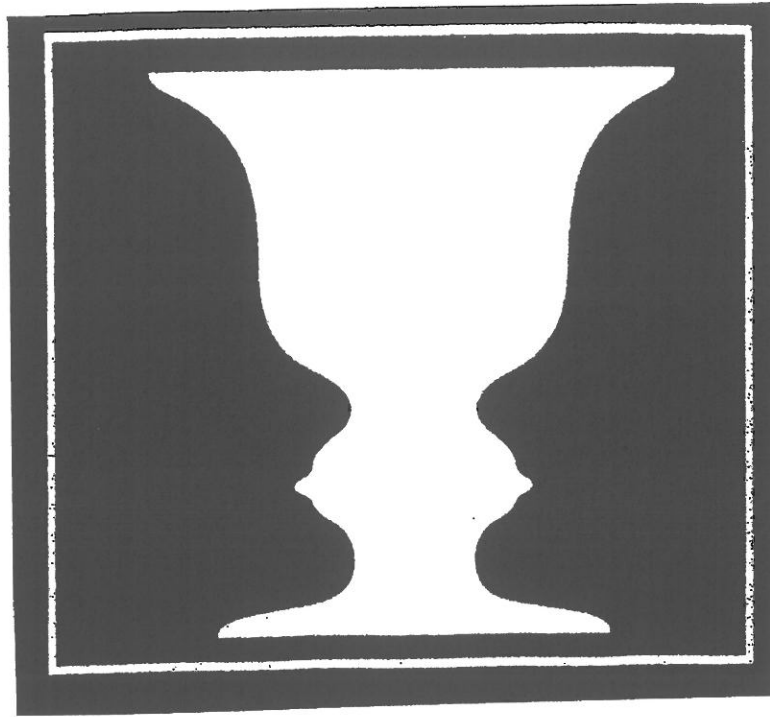


Figure 4: Rubin's illusion: faces or vase?

Figure

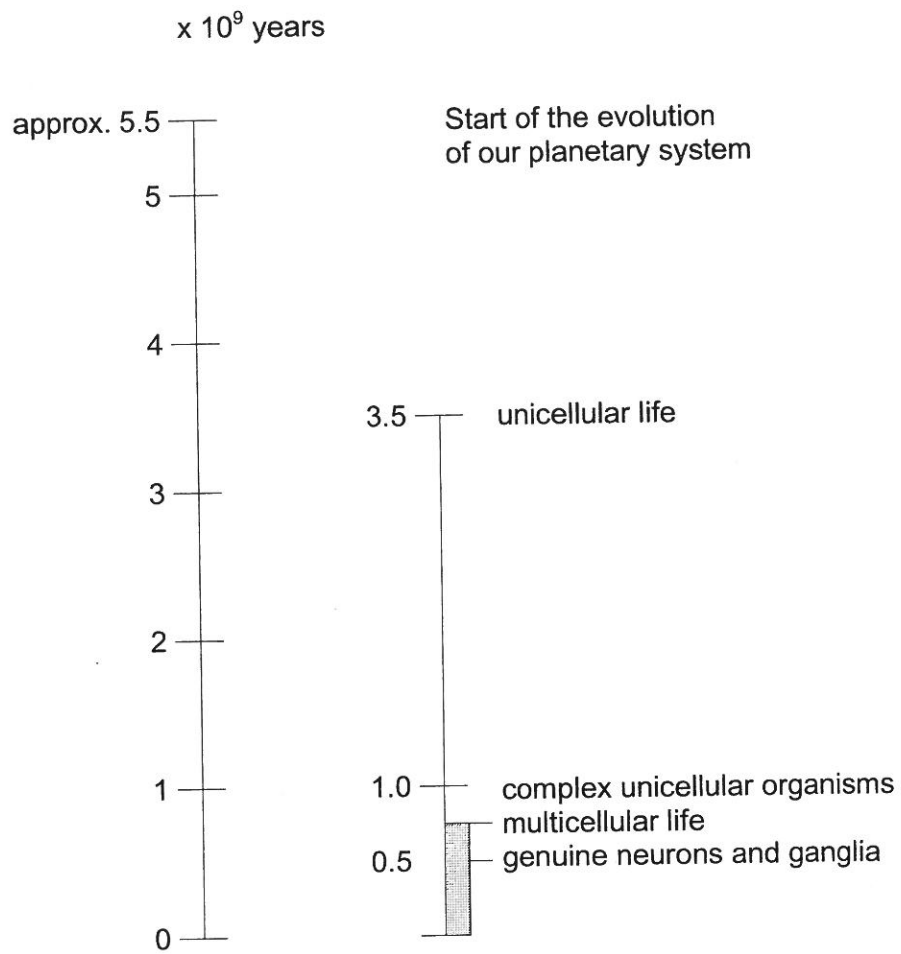
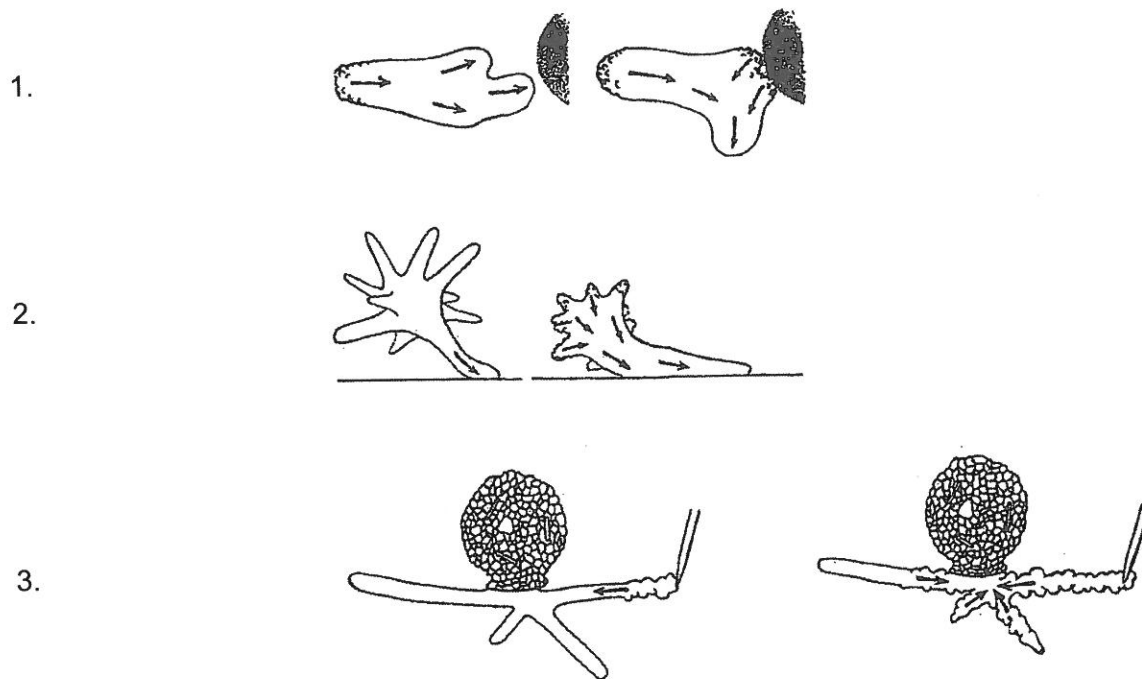


Figure 5: Evolution of life in our planetary system

Figure

Note: Figure 1: Negative reaction to a chemical stimulus

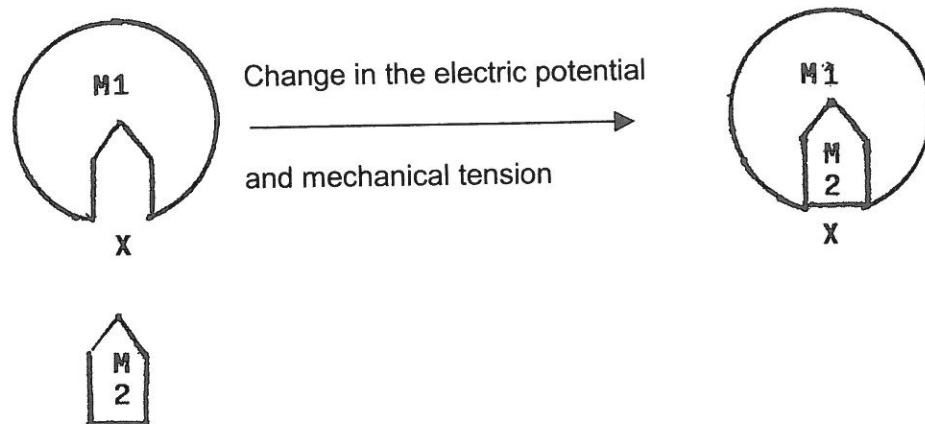
Figure 2: Positive reaction to contact with a substrate

Figure 3: Weak and strong stimulus with a needle,

→ direction of flow of the plasma.

Figure 6: Reactions to stimuli in amoebae (after Kühn)

Figure



Notes:

M1 = receptor molecule in the cell membrane

M2 = key molecule from the environment

X = membrane site of the quality-specific perception.

Figure 7: Key-keyhole model of perception

Figure



Figure 8: Vesicle formation and transport of matter through the cell membrane

Figure

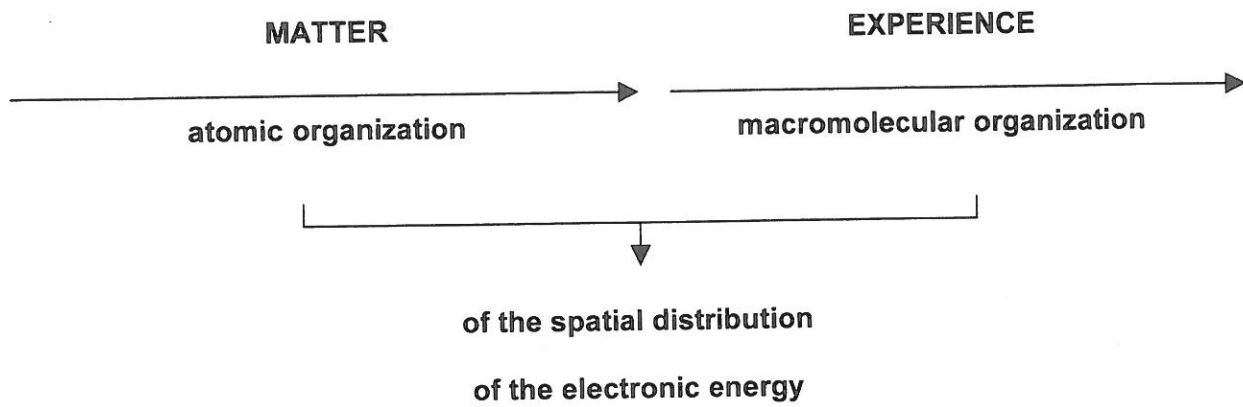


Figure 9: Organization of the spatial distribution of electron quanta