

SECHENOV LECTURE 2004¹

The relevance of Sechenov for the development of the theory of “an extended view of a human person as a social being”

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¹ In honour of I.M. Sechenov to the 175th anniversary of his birth 1829.

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1. OVERVIEW OF THE WHOLE PAPER

This paper is present in two parts with 4 chapters:

Part A deals with the Sechenov and his links to and compatibilities with the “extended view”. Part B proposes a draft of a blueprint of a model for the evolutionary process starting with the very early beginning up to the 21st century. This model seems to be compatible with the different sectoral views of parts of this process, which is explained by different “natural” and “non-natural sciences”.

- 1) In the following chapter I will describe the influence of Sechenov on science in and outside of Russia from a - maybe - unusual point of view: I will analyse his influence in context of the dynamics within the “paradigms” about the nature of life and body soul problem which were created in physiology and natural science during the live span of Sechenov. I will point out that the self-understanding of physiology and medicine has changed within this time span in an extreme way and that in the moment, when Sechenov died in 1905 many different ontological views were accepted in principle as scientific. So we should expect further paradigmatic chances too and not only additional knowledge according to the same paradigm.
- 2) Then I will demonstrate: Sechenov has seen the relevance and limitations of paradigms but of the technique of scientific work for the output of science, too. He was a very clear minded visionary for the possible progress in physiology depending on the changing of “paradigms” and an excellent experimentalist too, which could open the doors to go in direction to his visions.

- 3) Then I will point out why the used paradigm and the accepted epistemological frame are so relevant for the scientific output. I will use for this demonstration statements of A. Einstein and statements of B. Russell to explain the view of A. Einstein: The key sentence will be: *The theory defines what we can observe and in which way we have to interpret our phenomena*. What we cannot “catch with our paradigm and observation instruments for that we can not and should not give any answer. Therefore we have to fight for adequate “free inventions of the human brain - as Einstein defines any scientific theory and all scientific terms – to deal with all our topics on a level of “fundamental causality” – as physics and chemistry are able to do. This position is close to the position of Sechenov.

These is the summary of part 1. Part 2 deals with the evolutionary process from “Big Bang to Big Mac”. What has this to do with Sechenov, physiology and my personal work, which is focussed on an adequate understanding of medical aspects of the modern man?

I am specialist for Social Medicine and Hygiene and not physiologist according to the actual definition. But at the time of Sechenov the term “physiology” covered a much wider field, as we know from Nobel prize: “physiology” and “scientific theoretical part of medicine” were more or less the same at the time of Nobel (and Sechenov). So it is not a surprise that my goal to built a comprehensive theory of the “human person as a social being and its interactions with and expectations on his environment”(which is the title of the Th Kuhn Honour Lecture 2004, which is integrated in this paper, too) is very close to the vision of Sechenov: to built a physiologically based theory integrating all scientifically researchable aspects of the human, his body and his environment – and therefore the social environment too. At the time of Sechenov the link to the social environment and the aspects which are – in my understanding - specific for the modern human and different to homo sapiens Linné had to be excluded more or less from the physiological experimental research because of the lack on theories and basic data. But I have the luck of late birth: I can start with the knowledge of much more empirical data. And for my special position fruitful discussions with my Russian colleagues especially about the Functional system theory are indispensable. But our discussions have been very relevant about different experiments dealing with the physiological principles to modify the information, coming from the “outside”, too.

- 4) Therefore I will follow the request given with the invitation to give this paper and present same key results of my personal research I will use for this same key results of the Th. Kuhn Honour lecture 2004 I had the honour to give in August in London under the auspices of Nobel laureate Y.T. Lee and integrate actual correspondence with Lee and the Academia Sinica in Taipei.^{i, ii, iii}. The basic idea is that we should be able to understand the health aspects of a modern human better if we would have a conclusive model for the evolutionary process which is the basis of this man. But for this a hade to create same principles and characteristics which could be enforced by the empirical data of the different sectoral sciences. Therefore I will introduce same of them in part 2. I will focus on the most relevant aspects to understand the difference between cells of organs and tissues of an organism which is the instrument for the individual and the person. There are a lot of experiments of Russian scientists and knowledge based on the Theory of Functional Systems which is helpful for this view. These experiments explain that information, which is given to the “inside”, is all the time under control of the brain as the “Central analyst”. The “central analyst” modifies the neutral potential information from “outside” according to his assumptions, but wishes and expectations too before and during he is transferring the information to the function units of the body. So the “central analyst”, who can be seen identical with the “self”, creates with the help - but within the borders too - of very old biological function units a “matrix – world” for them. So the individual person can use them like machines for the individual demands of the modern person and therefore even for purposes, which are “brand new”, much younger, then the classic biological selection mechanisms can have a relevant influence on them. But the modern human with his abstract and final goals has no other function units in his body then the units, which were selected biologically for other purposes. The person has to take “what is available” by the body.

So I will finalise my presentation with an outlook: The proposed model can be seen as a continuation of the visions of Sechenov that at any time in the future it will be possible to integrate all processes including spontaneity, creativity and emergent processes into the “comprehensive understanding of Homo sapiens eco-socio-finals.

PART A: SECHENOV – PARADIGM SHIFTS – AND THE “EXTENDED VIEW”

2. SECHENOV AND CHANGING OF PARADIGM ABOUT LIFE AND BODY- SOUL-PROBLEM IN CONTEXT TO SOCIAL FRAMES.

2.1. The scientific progress and unscientific influences

If we discuss the progress of our scientific knowledge about life and the body-soul-problem we have to take into consideration that science takes place in a real world. Scientific topics and questions must be seen in the context of the given scientific knowledge and the goal of the scientist to improve the state of knowledge but in context of the given social and cultural frames too. Since Thomas Kuhn's famous book "The Scientific Revolution" we know, that the selection of research topics, the way to think and to formulate are influenced consciously and unconsciously by the wish of the scientist to survive and to have a career. And this depends on the social structure, too.^{iv} Therefore it is relevant to see these two aspects of goals of a scientist and their connection to another: To promote the scientific knowledge and to realise the subjective individual goals. For the understanding of the special situation of the body-soul-problem we have to take in consideration the results of Durkheim too.^v He pointed out the high relevance of the interdependences between social structures and the structures within the leading religious systems. And any religious society has the need to be distinct between possible participants of their communities and other creatures. Therefore it is a fundamental question for any religion to be distinct between human persons with their free will and the possibility to feel guilty and animals which cannot do so. Therefore it is to expect that any public relevant discussion about body-soul-problem must take place in the interference of scientific and religious interests. And the history of the 19th and 20th century is full of stories about this: So 1889 Prof. Raux was called on the chair for histology in Innsbruck University only after clarification that he would not accept Darwin's descent theory.^{vi}

2.2. The starting point: when Sechenov was born

When Sechenov was born 1829 in Teply Stan - a small place which is now named Sechenovo - the level of the understanding of the most famous scientists of this time about the principles of life, the nature of thinking and emotion was less appropriate than the understanding any qualified high school student of today has: Relatively good information was available just about the obvious anatomy e.g. of the brain. At this time nothing was known about neurochemistry, only very little about electrophysiology. The position of the cell in the organism was unclear (cell- theory by Schwann 1839 and then the Cellular theory of pathology by Virchow 1853), the principle of the function of the neurons were unknown (The neuron-doctrine was built by Cajal 1889 on the basis that each nervous cell is an autonomous entity), nobody has known anything about synapses (Sherrington 1897). The principles of inhibition were unknown, before Sechenov introduced this idea. The term "reflex" was not used in adequate way (before Sechenov). Enzymes were unknown too (1837 Berzelius formulated the catalytic principle of enzymes) etc., etc.

But as the scientific world today the scientific world of the beginning 19th century believed more or less that they would know all the relevant aspects in principle. The further scientific work would bring the progress to close the open gaps. But this progress would only extend and condense the knowledge and would not bring principle changing in the adequateness of the given knowledge. This was the consequence of the experience, that the scientific progress allowed such a lot of new applied helpful predictions.

But in reality in the early 19th century the new results of hard experimental data brought often more new questions than progress in the comprehensive understanding - according to the low level of knowledge and the more or less powerful paradigmatic support. So a creative scientist as Sechenov, who visited the different leading research institutes, could collect a lot of new facts, but facts which opened doors in dark rooms. And it was in principle unclear: are these rooms part of one building or maybe of two buildings?

2.3. Vitalism and Descartes:

Life as an essence – similar gasoline moving the car - and thinking – a flash of God just for men

Since hundred of years spontaneity, growing, but emotion and many other mind activities were explained by an invisible, limited and consumable "Vis Vitalis". This was the application of the paradigm of Aristotle (ca 335 BC): He distinguished between two principles: the "*dynamis*" (to explain matter and power) and the "*entelechy*" (to explain e.g. life and thinking). In the early 17th century Descartes formulated a very special modification of this dualism, which was accepted by the Christian churches. Descartes distinguished between "res extensa" and "res cogitans". Both were created (or expressions) of God. God has created matter and

energy (res extensa), which cannot be efficient by its own. But God created the natural laws too; according to them all extended entities have to interact. So the natural laws can be seen as the “frozen” omnipresent and omnipotent will of God do determine the processes of all consisting of res extensa. Therefore natural laws can be discovered. But according to the Dualism of Descartes res extensa included all living processes of any material being including the body of the human. Therefore many activities we would now call to psychology or mental activities too e.g. any emotions were expression of these natural laws. This was not in contradiction to the assumption of a Vis vitalis as a limited and consumable, unobservable but researchable resource independently from limited and consumable, unobservable but researchable resources for physical and chemical processes (different powers e.g. electricity) and limited and consumable material structures. Vis vitalis could be seen as a special aspect of the res extensa – without any relevance for the distinction between humans and other creations. But there was a second nature to use res extensa beside the “natural laws” and possible the vis vitalis: By “res cogitans”. Res cogitans was understood as identical with the eternal and immortal soul and restricted to the human persons. God gives res cogitans to the human as a special aspect of himself so that human is able to guide his body (made from res extensa) according to his free will (similar to God). Only the ability for logic and creative activities, the decision-making-processes of the person were understood as part of the res cogitans. Descartes understood the pineal organ as the interface between body and soul. Res cogitans was divine and therefore in principle from a different nature than res extensa. Therefore any research dealing with res cogitans was not allowed for science by the authorities of the churches – in agreement with the many governments.

So “life” was understood as Vis vitalis. Vis vitalis was seen like the indispensable resource to move the not living bodies like gasoline moves a car. If there is no gasoline the car stops and the animal dies. The person needs the last rest of Vis vitalis to expire the eternal soul (res cogitans) out from the body. This view was accepted by the scientific world up to the middle of the 18th century. Then French scientists started with a mechanistic and atheistic understanding of the whole world - typical for this position the statement of Laplace. He answered Napoleon to the question of the position of God in his world view, that he does not need the hypothesis “God” (about 1809).

2.4. The century of a growing number of paradigms and the teachers of Sechenov

Sechenov was a fully educated 21 years old military engineer with two years experience, when he started to study medicine 1850 in Moscow. He came therefore from a physical “world view”. We have to expect that he learned at Moscow University the state of the art and this was vitalism in Christian version. Immediately after his graduation 1856 he went to Germany to Johannes Müller and his pupils Emil du Bois-Reymond and Helmholtz, Hoppe-Seyler, and to France to Claude Bernard and to Ludwig in Austria, where he made relevant experiments for his thesis, before he worked two years in Graz, in a time when he was professor in St. Petersburg. He did a very clever selection of his teachers: All have been world famous physiologists and natural scientists, and “founder” of the “experimental method” in physiology and physiological chemistry, highly involved in the research of electrophysiology and experimental research of sensory organs, perception etc. But all have been fully involved into the creation and modification of new paradigms too. But they represented similar but not identical paradigmatic views. The individual positions of different teachers had changed in their life span before they met Sechenov, and some changed their positions afterwards again (e.g. Du Bois Reymond). We have to expect that they were in close contact over years. So it was the daily work of Sechenov to handle with the interactions with the new scientific techniques of empirical and experimental research work and their paradigmatic and epistemological basis. One of the outputs of this comprehensive scientific works is his world famous book (1863): *The reflexes of the brain*: This book is at the same time a classical scientific handbook but a philosophical volume too.

2.4.1. Müller and modification of vitalism

The centre for physiological research work in this time was Germany and the most famous physiologist was Johannes Müller in Berlin. He was the first scientific teacher of Sechenov. Many famous scientists were students or pupils of Müller not only Sechenov, e.g. Helmholtz, Brücke, Emil de Bois Reymond, Schwann, Rudolf Virchow and E. Haeckel. All of them have played a leading role in the progress of natural science as well as in the paradigmatic understanding of life and the body-soul-problem. Müller was vitalist. But he modified his vitalism from an idealistic position in direction to a materialistic position. He assumed a special Vis vitalis linked just with special structures. Therefore he formulated 1825 the up to now accepted so-called

“Müller law” from a vitalistic point of view: He has spoken from the law of “specific energies of sensory organs”. E. du Bois Reymond, his pupil and follower on the chair in Berlin, followed this direction: He published 1843 experimental confirmations of his assumption of identity of Spiritus animalis and electricity. Special versions of vitalism of leading experimentalist were common in France too. So Claude Bernard (1813 – 1878) distinguished 1865 between “influence vital” and the “cause executive” – close to Aristotle.^{vii} This is not a surprise: Bernard was world famous after his experiment (1849) to stimulate the 4th ventricle by a mechanical stimulus (“Zuckerstich”), which caused in the periphery an increase of the level of glucosis in blood. In which way should it be possible to explain such a process including the transformation from mechanics to electricity and from electricity to chemical output on a fundamental causal level? This means: on the same level as it is used in physics and chemistry: In these research fields causality is given only if unobservable qualities (e.g. an electric field, a chemical power) cause an observable phenomenon. With such a paradigm he could integrate his fundamental endocrinological experiments with his electrophysiological activities and therefore his view of the “milieu interieure” and metabolism. This based on an in principle researchable interferences between chemical, physical and neural activities. These experiments have been very stimulating for Sechenov: You remember the very famous experiments in Graz 1868 named the “White lady” and the fundamental publication in German language “Über die elektrische und chemische Reizung der sensiblen Rückenmarksnerven des Frosches” [About electric and chemical stimulation of the sensible spinal nerves of the frog] ^{viii}

An other version of vitalism was developed from an other pupil of Müller: Rudolph Virchow, the most prominent pathologist of this time and for many scientists up to now, the founder of the cellular pathology and modern social medicine. He published many papers in the most relevant journals of medicine about “new vitalism”: His position can be summarized in the sentence: “Therefore we pathologists are all vitalists”. Virchow could not accept a paradigm that excluded causal explanations of individuality and the influences of culture, political structures and modern civilisation on health and illness (and therefore bodily interactions to demands to the feedback systems which could be selected by the common biological procedures). The demands of Virchow can be expressed by the challenge on the paradigm to cover all the activities of a living being which fits to the following saying of K. Lorenz: “Gehörtes ist noch nicht verstanden, Verstanden ist nicht einverstanden, Einverstanden ist noch nicht bereit zum Handeln, Gesichertes ist nicht auf Dauer gesichert.“ [Perceived is not understood, understood is not accepted, accepted is not ready to act, realised is not permanent persisting]. For Virchow was clear: All this steps have to be done with the same materialistic structure of a person. But we know from our own experience that the answer can be different because of different value systems, influences of the environment etc. Therefore Virchow did not agree neither with a pure materialistic position of a modified vitalism, nor with the idealistic view of the “traditional” vitalism too. So he understood “vitalism” more as a “principle” for a realistic position.^{ix, x, xi} He deduced the “Lebenskraft” [Vis vitalis] from the interactions between the molecules.^{xii} Even 1897 he formulated: “Der Sitz des Lebens ist nicht identisch mit dem Sitz der Seele. Denn das Leben ist eine Eigenschaft aller Teile eines lebenden Organismus“. [The seat of life is not identical with the seat of the soul because of the fact that life is a nature of all parts of a living organism]. ^{xiii}

A total different solution of the former dualistic view offered another pupil of Müller: Ernst Haeckel (1834 – 1919, biologist but physician too) created a monistic paradigm to explain the open questions including evolution. In the monistic view power, mater and mind are understood as aspects of the same. Ernst Haeckel was the most prominent supporter of Darwin’s theory in Germany. Therefore it is not easy to follow him in his position that the evolution is determined – in contradiction to more or less all other relevant evolutionists. About his fight with the authorities and the Christian church we will speak later.

2.4.2. Helmholtz, Clausius and Darwin: Back to the starting point

But 1843 the mainstream of physiologists could believe in an obvious direction of the development of the paradigm: Vis vitalis would be discovered in the futures as the expression of a special matter (Müller) or by electricity. (Du Bois-Reymond). But then Helmholtz destroyed this hope with the discovery of the 1st law of thermodynamic: Energy cannot be won and cannot go lost. But it can be modified in any form. Then there is no explanation why electricity should have the quality “life” and other forms of energy not, and why “spiritus animalis” should be consumable. Maybe Laplace with his mechanistic worldview was right?

But the old view of Laplace – the assumption to need only the laws of classic mechanic to explain all in the universe - could not be accepted longer after Clausius 1865 formulated the 2nd law of thermodynamics and the term “entropy”: The predictions of “the daimon of Laplace” based on a model without an arrow of time.

It was clear: “Life” could not be a consumable, limited substance or special form of energy. But neither Helmholtz nor Clausius could offer a paradigm which was able to explain the reproducible phenomena: The power of the epistemological regulation (to increase knowledge in physiology and psychology on the basis of experimental testing of predictions) was greater than the available ontological frame (“paradigm”).

Darwin brought the most fundamental argument against the Cartesian view: He did not point out what is life or where is life coming from. But he pointed out principles about the differentiation of the species of living beings from fewer complex to more complex. Such an assumption was incompatible with the understanding of an identical, not modifiable essence to explain as well the “lower level” and “higher levels” of life, as the adaptive activities and the spontaneity according to a free will in unique situations of a human person. Why an egg of a chicken does not decide to create an eagle, or the egg of a dinosaur to build the body of a chicken if “life” is an essence, omnipotent and in all the living beings the same? If the morphology of the living entities must be seen from an evolutionary point of view then life - as the basis for this process - could not be a not modifiable essence.

The next fact was that selection will take place in a limited system if more demands are given than resources. For this process nobody has to determine a goal to select this or that: Selection happens with the consequence of the survival of entities in connection with their abilities in relation to other entities and environmental factors. There is no need to see a difference between the evolution of man and of any other living being. Therefore there was no more need to assume the creation of any species within seven days and of the eternal natural laws at the same time. And many scientists made the conclusion that then there is no need for a creator in general. Therefore the basic principle of Descartes and therefore the self-understanding of the Christian church were on disposition and not only the scientific paradigm of *Vis vitalis*. Beside the discussion about the paradigms for natural science and medicine a fundamental discussion about religion was to expect and – according to the links between religion and social structure – with relevance for the fundamentals of the given social stability. The problem was not the classification of *Homo sapiens* together with special monkeys in the same family. From the formal point of view this statement that *Homo sapiens*, Chimpanzee and Orang Utan are species within the same classification “Primates” was nearly 100 years old, when Darwin wrote his “origin of species”. Linné introduced this position in his 16th edition of his systematic without any problems with the church. But the classification of Linné integrated just the organism of the human into the same system as the monkeys. This was in agreement with the Cartesian world view: All organisms are *res extensa*, even the human body. Linné did not speak against the principle difference between the soul of a person and the level to guide the matter of the bodies in general. But exactly this brought the discourse about evolution and descent theory into discussion. E. Haeckel came to extreme positions and applied the evolutionary principle to deduce that even crystals would have a soul and published 1917 the book “*Kristallseele*” [The soul of crystals]. His monism was basis for a religion-like association (“*Monistenbund*”). They elected Haeckel as “anti-pope”.

So not only the scientific discussion about the adequate paradigm was in turbulence but the discussion about the fundamentals of the former given social structures too.

But at the same time the changing in the epistemological self-understanding which had taken place in the 19th century was extremely fruitful: Scientists like Müller, Ludwig, Bernard founded the epistemological agreement for experiments in physiology (and biology) as the basis for science. They postulated that the theoretical assumptions should be so exact and detailed that from them the output of standardized experiments should be possible: The experimental phenomena should be the judge for the adequateness of theories. Reproducible results were the goal.

Such experiments were done in many different fields of physiology. They brought reproducible results, but the knowledge about the predictable links between the different fields was not available at this stage of the state of knowledge. This should be the function of a paradigm within science. But the given puzzle stones were too different and could not stimulate to create unification by a new paradigm which allowed fitting all reproducible data into one big puzzle.

2.4.3. How to handle science without an adequate paradigm: 2nd Copernicanean Revolution, Emil du Bois-Reymond's Ignorabimus, Positivism, Morgans Canon and other proposals

The paradigms offered by religion and by the different views of Vis vitalis, matter, power and mind could never cover the plurality of reproducible phenomena. How to handle this situation?

*2.4.3.1. The starting point of modern epistemology:
Kant and the 2nd Copernicanean Revolution*

Immanuel Kant published his first critics 1782. He came to the fundamental result that the basic assumption of empirism, the human person would be able to make objective statements about objects in the real world – statements without an influence of the observer - can never be accepted: There is no “tabula rasa” a priori (= before any observation). We need “a priori” a “coordinate system” for positioning the stimuli from outside (“space”) and for the process (“time”). Therefore the observed stimuli are coming to the main a posteriori: sorted according to time and space. And they were handled with given “categories” (e.g. causality, quality, quantity) for synthetic judgements. So Kant changed the understanding of the relationship between observer and observed object in principle. The first Copernicanean Revolution was the cognition that not the earth is the unmoved centre and the sun is moving but the sun is unmoved (only in relation to the planets) and the earth is moving. So the common view is a simplification humans used unconsciously. Therefore the human has fixed (and can change) the point Zero of his coordinate system to characterise positions of matter in outside space (“commonly” the Euclidian room), but time too. Now Kant cleared up that this coordinate systems and the categories are creations of the human brain, which allow the humans to deal with the outside given daily life more appropriate. But we can not know more from the outside given as the fact that aspects of it can be brought into the coordinate systems of time and space and can be handled with the categories. Therefore we can not know how relevant the aspects we can handle are from an objective point of view to speak about the outside object we observe. And the 2nd fundamental change deals again with the point zero to characterise relationships: The point zero for natural science is not “outside” but inside of the human: in his mind.

This argumentation based in idealistic foundation of knowledge only. Materialistic arguments are not needed (and would not be accepted in this type of argumentation). But you came to the same result if you would use classic materialistic arguments, as Helmholtz confirmed: a person is limited by his sensory organs to perceive just a small segment of the given: Therefore he can have “a priori” just information about this small segment of a whole which can in principle not be known by humans in toto. And the input of this perceivable information from the world must be valuated by a biological organ, which limits what we can know, and in which way we can connect the information according to time and space and a priori categories. But the brain allows on the other side an individual valuation. This valuation has to be done with regards to consent too. (Without orientation on consent there would not be an explanation why we can communicate even about dissent). Therefore the acceptance of the physiological basis of the human confirms the so called 2nd Copernican Revolution in epistemology: We can not make any statement about reality which is objective in the sense that it is not depending on the quality of the observer. (Physiological or sensorial New-Kantianism). Einstein confirmed later that this position does not change if we use artificial observers: They are limited in the segment of their “observations” too. The position of the “physiological New-Kantians” allows with regards to other physiological knowledge (e.g. of genetic and epigenetic) the conclusion, that all “a priori given” is based on genetically based information and the categories maybe too (or on epigenetic principles) Then we can understand that they are characteristics for all members of the species Homo sapiens. Therefore all humans correspond in these. And these correspondences can cause a “lower level” of “objectivity” just within humans. And physiology can be seen as the science to describe this generalizable basis from the morphological side. Helmholtz is seen as the “founder” of “physiological New-Kantianism”, Müller, Fechner and Emil Du Blois-Reymond are counted to the most relevant representatives.

2.4.3.2. Again Bois-Reymond: Ignoramus and Ignorabimus and epistemology instead of/ as paradigm

And Emil Du Bois-Reymond, a teacher of Sechenov, modified his former position (spiritus animals can be explained and is identical with electricity) and offered a radical solution for the given dilemma between the inadequate ontology (“paradigms”) and the much more powerful epistemology (to use well controlled

experiments in biology too): He presented this position in two speeches (1872 and 1880) to the leading association of natural scientists and physicians of this time in Germany. In his speech to the 45th annual assembly of the Gesellschaft der Naturforscher und Ärzte “Über die Grenzen des Naturerkennens” [About he came 1872 to the conclusion, that there are seven “Welträtsel” [world mysteries]. He assumed that 4 of them are in principle not to explain with scientific methods even by the progress of knowledge: “Ignoramus et Ignorabimus” [“we do not know and we will never know it]:

- Das Wesen von Materie und Kraft [The nature of matter and power]
- Ursprung der Bewegung [The origin of (spontaneous) movement]
- Entstehung der einfachen Sinnesempfindungen; Bewusstsein [The origin of simple sensory perception and consciousness] and
- Willensfreiheit: [the freedom of will].

The three questions, which are now unknown (Ignoramus) but which could be solved with the progress of science in the future, were:

- Die Entstehung des Lebens [origin of life]
- Die anscheinend absichtsvoll zweckmäßige Einrichtung der Natur [the obviously intentional and efficient orientation of natural processes (and therefore explanation for the obviously high efficiency of science)] and
- Das vernünftige Denken und der Ursprung der Sprache [the rational thinking and the origin of language]

He pointed out that we would not be able to understand the nature of the psychological processes (but other basic inner causes for physical effects like movement too) even if we would have the knowledge of the daemon of Laplace and would know all positions and interactions of molecules and atoms in the brain. And there would be no hope to answer this question on the same level, as it is possible to answer phenomena in consequence of outer (observable) causes. This speech was a natural philosophical presentation with a clear ontological position and relevant epistemological implications: There are bodily and mental phenomena. They are caused by “inner and outer causes. They cause effects which follows general principles. But the nature of the human is so that we will never be able to deal adequately with the (unobservable) “inner causes” and their connections with the observable “outer causes” in such a way on the basis of logic arguments that we can call the result “knowledge”. Therefore the question about “inner causes” is correct in principle, but hopeless. This position was a new paradigm about the nature of the human being – more radical than the former Christian position (we will never know the nature of God and therefore the nature of “res cogitans”. Res extensa including life and emotion are based on created natural laws and therefore “researchable”). If you accept the position of “Ignorabimus” then it does not make any sense to spend time and money to try to solve these questions on a fundamental causal level (To explain phenomena by inner and outer causes). Any discussion about “vis vitalis”, “to be”, etc. is fruitless for science (“metaphysic”). Therefore the only consequent solution to improve knowledge is to use the best available epistemological technique. And according to the power of the newly implemented epistemological technique (of the sophisticated, well documented and therefore in principle for everyone repeatable empirical experiment) this epistemological ongoing should be the stay of knowledge in science. One epistemological consequence of this position was the need to accept an additional type of causality: Causality was to accept if all the steps of the chain of causes and causal connection were made observable, too. (This was and is not accepted in physics and chemistry: They explain observables with unobservable – inner – causes like fields and power) A second consequence of the “Ignorabimus-position” was that it was /is to expect that connections should be discovered, based finally on “inner causes” of biological and psychological processes too. How should a person, which accept this convention, deal with such a “discovery”, if there are no offers to characterize and communicate the different unobservable aspects e.g. of perception, valuation, initiation of a reaction etc? The accepted possibility was to introduce a new quality of “comprehensive terms” for the whole complex: This term includes at the same time the observable starting point [e.g. the normal dog], the (not observable) inner cause(s) [e.g. the ability to link meaning with observable and pose this within a coordinate system for meanings], the (not researchable) process caused by these inner causes and the observable output [to change the meaning of a sound which is linked with an other observable phenomenon e.g. feeding] and the observable output [a now conditioned dog]. Then you have to motivate the scientific community to accept this term because of the reproducibility of the output under well controlled experimental conditions. [I conditioned dog is now a conditioned dog because of conditioning]. This technique is the only given if the basis of empirical data does not allow more differentiated assumptions but of course if you accept

“ignorabimus”. It was used with great success by Sechenov and his pupils but from modern scientist all over the world too. Indispensable terms as “conditioning”, autopoiesis, “homeostasis” are such terms. But it was all the time correct to ask about their nature (“inner causes”). But there was and is a convention that such questions are counted under “hopeless”. So the epistemological agreement substituted the ontological discussion. The basis is a “convention” within the society of scientists.

2.4.3.3. Positivism – Mach and Sechenov at the same time in Graz

This opens the link to a philosophical direction called “positivism”. Its founder is Auguste Comte (1798-1857). The most relevant representative in science at this time was Mach. Mach worked in Graz, when Sechenov made his experiments about the “white lady” in the same town. The “pure” positivist excludes all discussions about “inner causes” as fruitless and accepts only that what can be observed (the “objective”). Therefore he should not include explanations on the basis of power or fields in his theories: They cannot be observed but their “output”. Such a “pure positivism” would cause a loss of indispensable theories and applications in science and its application. Many natural scientists used (and use) therefore positivistic positions in a pragmatic way: They use the unobservable physical and chemical powers and fields but they take a positivistic position in context of life and psychological aspects of the same entities. For a critical thinker this is compatible with the assumption that positivism is a “must” if the available empirical data are not powerful enough for an adequate paradigm. Therefore the adequateness of a positivistic position would depend on the available data. There are many statements of Sechenov to assume that he used positivistic epistemological positions because of the very limited data about life and mind, but “fundamental causality” with inner and outer causes for physics and chemistry. But his ontological position can be understood as a “physiological new-kantianistic” one.

2.4.4. Sechenov and new understanding: Epistemology and ontology as tools

2.4.4.1. Kant and physiological New-Kantianism

The technique to use two epistemological positions within the same chain of argumentation seems to be conclusive from another position too. My analysis of the work of Sechenov shows close relationships of this position with Sechenov: If you accept the 2nd Copernican Revolution then epistemological (and ontological) views are “free inventions of the human brain”, too. They can be created only on the basis of experiences. The experience depends on the available data. Therefore the level and the comprehensiveness of the available data about nature limit the correct thinkable ontological model. Such an assumption would see the level of empirical data, the possible conclusive paradigm (“ontology”) and the adequate epistemological recommendations as interdependent and in a dynamic process. Then the used paradigm would play the role of a pragmatic frame to bring different aspects of knowledge contradiction-free in a very general connection and epistemology would be comparable with a toolbox from which you take out this instrument which is adequate to solve the given problem. And with solving of problems the level of the frame and the content of the toolbox will improve too. From this point of view it is adequate to use for physical and chemical questions of living beings a level of argumentation which is more fundamental (because of the well experienced use of inner causes like fields, energy and power), but for expressions of living processes of the same entities a less fundamental argumentation. Another consequence of such a pragmatic view of paradigm and epistemology deals with the predictability of “unsolvable world mysteries”. This depends on the available frames and tools too. Therefore we should be very careful with statements like “Ignorabimus – we will NEVER know it” about “world mysteries”: We see only the available toolbox and the accepted paradigmatic frame. But they can be and should be adjusted in context of the new empirical based knowledge. This seems to be the position of Sechenov: He used often the term “Ignoramus – we do not know” – but not “Ignorabimus”. And Einstein demonstrated: If we accept a shift in the paradigm (Gravitation is not understood as a power, space and time are for physical objects a continuum) and in the epistemology (“Real theories” allows to link former logically contradictory theories) even a “world mystery” can be lifted: The equivalence of the (unobservable) energy and of (observable) matter is a fundamental scientific statement about the “nature of matter and power, which was counted as “Ignorabimus”.

2.4.4.2. For” technical guidelines” but against “doctrines”

Especially in periods with a lack on reproducible data scientific community needs criteria to guide their members to a type of research work which will fill the gap as quick as possible. But – in agreement with Th.

Kuhn - we should not be surprised that the “scientific communities” will abuse the need to guide scientific work for “outer-scientific” interests too. So they used (and use) such pragmatic positions uncritically to distinct between scientists which are acceptable as “members” and such one which are not acceptable. They used such guidelines like “natural laws” or “doctrines” – similar “dogmas”: E.g. Morgan’s Canon³ or the position of Watson (1919), who claims to exclude “consciousness” from natural scientific and psychological research. But we know that in history no paradigm was “the true”. One followed the other. This should be acceptable for the dealing with unobservable and “inner causes” too. And one century before Th. Kuhn published his book (1963) Sechenov has applied this position, not to accept guidelines as laws, e.g. when he accepted to discuss positions about “will” as a cause for inhibition with regards to the reputation of the proposing person (it was Weber) as experimentalist (1863)^{xiv}. This position is one of the reasons why Sechenov had so many conflicts with officials.

“Will” was a common topic of spiritualists. To deal with “will” was for many physiologists unacceptable – like a “doctrine”. Therefore they excluded such topics from their research field. Therefore no progress could be expected. Not so Sechenov. He did not accept the paradigm of spiritualists and therefore their explanation that “will” is the expression of a special essence. But he accepted the relevance of the phenomena linked with individual “will” for the understanding of man in general. Therefore he has accepted the need for causal explanation but consistent with the other phenomena known from humans (in biology, physics and chemistry) as a long term goal for physiology.^{xv} There was a need for appropriate epistemological techniques. He proposed such ones. For that he needed a paradigm about the expected “nature of the spirit and its dependence on the body.” Therefore he formulated paradigmatic positions e.g. in his “The reflexes of the human brain”, like “*all the external manifestations of brain activity can be attributed to muscular movement – even Garibaldi’s smiling when he is persecuted for his excessive love for his fatherland as well as the laughing of a child or Newton’s enunciating universal laws and writing them*”^{xvi}. It is obvious: These movements were used to carry information (the position of meaning in its coordinate system), not to change the position of matter in space and time. But without this material movement no communication! The interdependence between both – the observable movement and its guidance - could be made to a research topic with the given techniques to come closer and closer to the secrets. Sechenov deduced from his physiological experiments step by step principles for the interactions between the unobservable inner processes in any biological analyser (and receptor) and the observables of the associated process: According to physiological experience the “analysing” activity is all the time the middle part of a process between an afferent and an efferent axis (and therefore part of an integral whole).⁴ The level of thinking, the quality of the emotion etc. can be maybe more or less complex. But there are no links between such “analysing activities” without such intersecting morphological steps.⁵ Therefore Sechenov claimed psychological problems as part of physiology and did not exclude them.

2.4.4.3. Progress by introducing abilities on a monistic position

But even when Sechenov died there were no adequate empirical data available to propose similar tools for analysing psychic processes as “field” and “power” are used to deal with physical and chemical processes. So the best available technique was to fill the gap with comprehensive terms (e.g. analyser, receptor, conditioning...) and the use of techniques which allowed concluding from the experimental results to the content of the “comprehensive term”. But from the view of a progressive scientist who did not accept “Ignorabimus” this situation was similar to the status of physics when “horse power” was as a physical unit: This is a pragmatic solution - helpful but only temporarily. A progressive scientist would be willing to step forward on the way to characterise the “inner causes” more adequate with the increasing level of available

³ Morgan’s Canon recommends to handle the following doctrine like a natural law: Do not use an explanation for a phenomenon on the basis of a principle which is the expression of a higher evolutionary level as long as we can explain the phenomena with principles which are based on explanations for “evolutionary older” research objects. Therefore a psychological principle should take in consideration only if it can be excluded that physical and chemical explanations are sufficient. An example for such reproducible phenomena which are not sufficient to predict just with physical and chemical principles is toxicity and its special case “placebo”.

⁴ “*Shall we isolate the middle of an integral whole, calling it psychical, and opposing it to the rest of the whole, calling it material?*” Sechenov, I.M: Who must investigate the problems of Psychology and how, Opera, p 349. This statement can be understood as confirmation for a monistic position of Sechenov.

⁵ This is a relevant argument why scientific models, which not integrate such biological principles for the transfer of information, can be logically correct but not generally applicable on reality.

and connectable empirical data, all the time remembering with Einstein that “all scientific terms are free inventions of the human brain, created just for better handling of reality.

Anokhin and Sudakov made such a “free invention” which brought progress in epistemology and especially for applicability: They use in their Theory of Functional Systems an ability (NOT a specific force!) to explain the processes within living systems e.g. self regulation, plasticity, auto regulation etc. (see e.g. Sudakov 2002 pg 5)⁶. A similar position was done by the Nobel laureates Heisenberg (in the field of qwanta^{7, xvii}) and Muller (in the field of genetics.^{8, xviii}). These scientists did not accept the assumption of a dualistic Cartesian paradigm. They accepted a materialistic and monistic nature of their research objects.⁹ They all brought “abilities” into discussion to deal with reproducible phenomena which were not to explain with the given energetically characterized “abilities”, e.g. for movement (by fields and powers). In a “monistic view the term “ability” is used to express the assumption, that because of this aspect a research object can be efficient just in a definite way. The postulation of ability is one step forward from the epistemological technique to cover the unobservable part and the reproducible observable results just with a comprehensive term (e.g. the term “autopoiesis”). The next step in the epistemological progress would be to postulate characteristics of this ability and its relationship to other abilities of the same object. These assumptions should allow predictable phenomena. This would be the way which was done in physics and chemistry with the consequence that on theses fields generalised predictions on the basis of inner causes are the standard now.

2.4.5. Psychology - Spiritualism – Psychosomatic

Parallel to the developments in physiology different scientists of the 19th century focussed on psychical problems using the different paradigms available in this time. Therefore the physiologists brought in an indispensable contribution for psychology too, as physiology is the mother of Pathophysiology, Medical Chemistry, Biochemistry, Public Health and Social Medicine etc. So Sechenov is counted in the list of the most prominent psychologists, too.^{xix} His theories about psychology are indispensable for the understanding of modern psychology.^{xx}

2.4.5.1. Spiritualism

But there were incompatibilities between the position of Sechenov (and natural science) and these representatives of psychology who accepted a spiritualistic and/or a dualistic position, which includes all aspects of *vis vitalis* and the Cartesian “*res cogitans*” as one part of the nature of the human person and “*res extensa*” as the other nature of man. The relevant arguments of Sechenov against psychology must be seen from this position and can not be applied against all other specialisations from psychology. Sechenov was fighting against spiritualism!

Sechenov has described the position of the “spiritualists” in his paradigmatic paper “Who must investigate the problems of psychology, and how”, p. 354:

- 1) *Man, as an independent part of the universe, - as a totality in itself, - may be contrasted to the rest of the universe; man may be isolated from everything, which is outside him. In this sense man is an individual, an integral whole, a unit.*

⁶ P.K. Anokhin was the first to demonstrate that living matter possesses a dynamic ability to converge and form discrete autoregulatory functional systems, whose activity provided adaptive effects, useful for the organism. Physiology of functional systems – A textbook for medical students, in: Sudakov K (ed.) compiled by Sudakov S, Glazachev O.S., Vagin Y.E. and E.G. Ionkina, Sechenov Moscow Medical Academy, Moscow 2002.

⁷ Heisenberg proposed a “Potentia” as an ability of the quanta to cause their changing in movement “between necessity and arbitrariness”.

⁸ Muller started from the position that chemists generally accept that chemical structures are able to cause autocatalytic processes to reproduce themselves. Therefore he has seen it as correct to assume that they have an autocatalytic ability. But autocatalysis can not explain the phenomenon, that the organic structure of the genetic material is able to determine totally different structures, e.g. the colour of the hairs. This phenomenon needs a sufficient explanation. Therefore Muller brought in papers – published in Russian – an additional “hetero-catalytic” ability in discussion.

⁹ From this point of view it would be correct to understand “energy” as the name for the “ability to move matter in space and time”

- 2) *When we regard the sum of phenomena taking place in man, we see that man is composed of two principles, which are not subject to the same laws.*
- 3) *As a corporeal being, matter is subject to the laws of the material world; as a spiritual being, he is not subject to them.*
- 4) *In his corporeal aspect, he is the slave of matter; in his spiritual aspect he is its master.*
- 5) *Man does not only have power over his body and control his behaviours; his power extends even to his thoughts, desires and passions.*
- 6) *In this sense, man is an independent being; his actions are determined by himself.*

Sechenov could falsify the position of man as independent from his bodily nature. He could confirm his integration into his environment.¹⁰ But Sechenov was not a reductionist: He understood the nature of human as the result of an evolutionary process which covers bodily and mental abilities. Therefore as well the natural laws of physics and chemistry are indispensable as the principles of biology and therefore of physiology, especially the principles of the neuronal system. The progress of evolution did not stop on the level of animal life. Because of this natural process human beings are different and not because of a special dualistic force. But because of the same reason there are differences between different evolutionary levels of lower and higher animals too and there are differences between them and *“the life of plants and rocks”* (S. 341). For Sechenov the problem for science is that we have no scientific technique to ascend from the lower level to the higher level: *“To ascend from them [the psychical processes of animal life] to more complex phenomena is impossible; immediately below them [the psychical processes of human] stand the unanalysable phenomena of the psychical life of animals; and still lower lies the sphere of inorganic matter.”* (Opera, p. 341).

As long as this situation is given and we have no technique (based on a paradigm covering all the different levels of evolution based entities) we can not expect an explanation on the same level as within physical and chemical processes. But Sechenov explained the epistemological correct way which was given at his time: There are a lot of basic processes which are indispensable for the psychic processes of humans too which can be analysed with the methods of physiology. Therefore the best and indispensable basis for the better understanding of psychic processes is physiology.

The modern psychology deals with physical phenomena without a paradigm of “psyche”. Same concepts seem to be close to the principles of Functional systems Theory, e.g. the concept of transactional coping of Lazarus: He takes the position that a person is observing permanently its environment even in case of stress, evaluates them (appraisal) and selects (the (psychologically based) coping technique, compares the effect of them (permanent reappraising) and modifies the coping technique in agreement to his assumption about the situation, his coping resources etc. (transactional coping).^{xxi}

2.4.5.2. Placebo, Phantom pain and other open problems

But there were good reasons for a scientific frame which covers topics which are not to handle with a model just based on the actual understanding of morphology, matter and energy. These are the arguments we know from Virchow (e.g. the very relevant differences of contagiousity of the same microbe depending on different social classes), from psychiatrics (see the arguments of hysteria, depression, etc. e.g. by Jean-Martin Charcot 1877), but from reproducible physiological phenomena too: e.g. of phantom - pain (Weil 1871), suggestion and autosuggestion (e.g. by Coué 1885; which were named by Sechenov as causes for modification of reflexes but excluded by special experimental techniques e.g. 1902^{xxii}), “Placebo-analogue” phenomena¹¹, the *“well known phenomena”* of *“consciously and unconsciously used motivation”* - as Sechenov pointed out as an effect of singing if tired to increase the efficiency of work (in the same paper , p 258).

¹⁰ *„But if we examine the real essence of these aphorism ...the absurdity of most of them becomes evident: ..It follows, from this that whenever man is spoken as of an indivisible totality, a unit, the word “man” denotes the physical, material nature of man, and nothing else.”* Sechenov I.: Who must investigate the problem of psychology, and how, Opera, 354 This confirms the assumption of a materialistic position in agreement to a materialistic evolution based monism.

¹¹ *„Es versteht sich weiter von selbst, dass der dem Versuch unterliegende Mensch die Metronomschläge, welche die Zeit messen, wo seine Hand in der Säure bleibt, nicht hören darf.* It is evident that the person in the experiment must not be able to listen the metronome which is counting the duration during the hand is in the acid, Sechenov I: Physiologische Studien über die Hemmungsmechanismen, Opera, S. 171

2.4.5.2. Freud and his followers: a root for psychosomatic

Sigmund Freud created his theory at the end of the 19th century, based on a posthumous paper. He proposed a comprehensive view but on the basis of assumptions about inner causes. He linked a complex network of such forces (?) finally with bodily results. It is to assume that Sechenov would have had difficulties with this theory because of his position, that “between” different physical activities bodily processes are indispensable.

Freud is not a representative of psychosomatic medicine but indispensable for the development of this additional branch of medicine, which is accepted by many medical universities beside the “natural science based medicine”. In the given situation in Austria we have the position that there are two types of school medicine. Both are accepted as indispensable: “A medicine for bodies without souls, and a medicine for souls without bodies” – as Th. V Uexküll formulates. They are unlinkable because of their different ontological and epistemological basis. In good agreement to the position of Sechenov: The scientific linkage between the lower and the higher level is with the given instruments not possible

Psychosomatic view starts “the other way round”: Psychosomatics starts with a paradigm about inner processes which could be confirmed by statistical methods to have significant correlations with bodily functions. Some of them are powerful in the prediction of effects, too. It is remarkable that same principles accepted in selected “schools of psychosomatic” are very similar to basics in Functional Systems Theory: So Th. V. Uexküll and Wesiack^{xxiii} use the so called process of “Merkkreis and Wirkkreis”, a concept based on proposals e.g. of Gelen, Weizsäcker V., (1886 – 1957, Gestaltskreis), J. v Uexküll: These circles look similar to a permanent working reflex between an receptor and an analyser which integrates environmental input with mental and bodily reactions. These are positions which give hope to link aspects of psychosomatic medicine with physiological principles.

2.4.6. From creationism to the Evolutionary Theory of Darwin (and K. Lorenz)

The most prominent paradigmatic shift during the lifetime of Sechenov was the introduction of Darwin’s theory of evolution. At the beginning of the 19th century two controversial theories were in discussion to explain the fossils: The theory that all living beings were destroyed by catastrophes, so that God had to create different times new ones and the theory of one creation and a modification of the animals because of the changing of environmental conditions. The Catholic Church preferred the first version more, but the other was not in contradiction to the religious self-understanding. The systematic of Linné was in agreement with the paradigm of the church too: He listed – as pointed out above – the Homo sapiens together with Orang-Utan and Chimpanzee into the family of the “primates”. But this did not include any statement about the nature of res cogitans: Living processes were subsummed with physical and chemical processes into the effects of “res extensa”. But the theory of Darwin and its interpretation by his followers excluded a special nature of the soul. Therefore this theory seemed to be in contradiction to the position of the church, which insisted in a unique position of man. Therefore the dispute about evolution was overloaded by political and social aspects. Therefore the position of spiritualists was supported by the church and many governments. This controversy could not be brought to an end within the life time of Sechenov. One of the main arguments against the Cartesian view was that an omnipotent essence would have been able to create from any egg at any time all types of animals which produce eggs. But from any egg of a chicken all the time only chickens came out, no eagle or dinosaur. But the Darwinists had also open questions: The problem of the evolutionists was that they could not explain the nature of the creation of “in principle news”. They could only describe prerequisites and the follow up of steps on the way to them. So Darwinists had to accept a gap to bridge the most relevant step: When the new was caused just by the given and why this take place in an unpredictable way – but in a researchable world for which reproducibility and predictability are the “conditio sine qua non” for science. But the epistemological self-understanding based on “Ignorabimus” and the “acceptance of comprehensive terms” allowed explaining this with consent about such a new scientific term: This term was “emergence”. And e.g. Broad brought a definition of emergence, which was sufficient according to the prerequisites of the new epistemology:

The “emergent” is based just on the given, without any influence from outside of the system (e.g. by an influence of God). It can not be predicted when and in which form the emergent occurs. And the “inner cause” of them must be accepted by the natural piety of the scientist.

This definition allowed handling the observable adequately. But not because of a characterisation of abilities of the entities, which allows to deduce from them the possibility that these entities – or any other actor – are able to create the “emergent” or more complex entities. But within the scientific community “inner causes” were never needed for a causal explanation.^{xxiv}

It is understandable that at this time the evolution of special psychical aspects were not matter of science. But Darwin had integrated all aspects of species into his theory. He used the principle of the “survival of the fittest”, which was formulated by the social scientists Spencer to characterize the output of the evolutionary process. This position integrates the use of psychical activities for this fight too. Sechenov integrated into his understanding a comprehensive view of evolution. And he pointed out clearly that the evolution of mind was accepted at this time as a part of evolution of species.¹²

But this general position got lost in the early 20th century. So it was the merit of K. Lorenz – Nobel laureate for Medicine and former Honorary President of International Academy of Science – Health and Ecology – to re-discover this position. He expressed this in the sentence: “*Evolution ist ein erkenntnisgewinnender Prozess*” [Evolution is a knowledge gaining process].

2.5. The situation when Sechenov died

When Sechenov died 1905 the epistemological and ontological basis of scientific medicine has changed in principle: If we use as criterion for that the accepted ontology and epistemology of the papers which could be published in the leading journals and the positions presented to the leading scientific societies we have the following situation: We can say that at this time “natural science” was defined not by ontology but by epistemology as follows: Scientific statements have to be based on reproducible experimental data and the use of (Aristotelian) logic argumentation, which allows to integrate the given stay of knowledge with the reproducible und predictable phenomena. If this was given, the ontological basis could be different: A “pragmatic” positivism was typical for many fields of biology and physiology, but different types of “vis vitalis” – especially the version of the very powerful pathologist R. Virchow - could be presented in the same society and journal. Monism was accepted by the scientists around Ernst Haeckel who is indispensable for the modern understanding of biology and evolution theory. Einstein could explain the former incompatibilities between Newtonian view (movement caused by one dimensional powers, need of integration of position of the observer for scientific statements about movement) and Maxwell’s view (movement e.g. of light caused by fields, statements about speed only correct by excluding the position of observer) just by a in general different understanding of inner causes of physical entities (a new understanding of field) and an extended view of epistemology and ontology (all theories are free inventions of the human brain, science without ontology is impossible, indispensable but logically not compatible theories should be handled by a special form of metatheory which he called “real theories”) and S. Freud laid the fundament for a scientific view from a total different starting point. But beside of them a lot of scientific unacceptable offers on the basis of creationism, vitalism and spiritualism were offered but excluded from science by the criterion of the missing experimental confirmation and the lack on a logical linkage to the given indispensable stay of knowledge. This we should take into consideration when we think over about the sentence of the famous clinician Naunyn (1900): “*Medizin wird Naturwissenschaft sein oder wird nicht sein.*” [Medicine will be “natural” science or Medicine will never be].

When Sechenov was born the most natural scientists accepted that life is a limited, consumable resource which allows us using the other type of limited and consumable resources (matter and energy) for a special form of activity. When Sechenov died, the majority of natural scientists agreed that “life” is a term to express a special process of material entities, organised in a special way and using special structures (e.g. the proteins of the protoplasm).

3. ANALYSIS OF THE POSITION OF SECHENOV AND HIS INFLUENCE ON HIS FOLLOWERS

¹² „Darwin’s great theory of the evolution of species has placed the idea of evolution, or successive development, on such a firm basis that this idea is at present accepted by the vast majority of naturalists. This logically necessitates the recognition, by the majority of naturalists, of the principle of evolution of psychical activities.” The elements of thought, Opera, S.410

3.1. Sechenov as a philosopher

3.1.1. Sechenov und the use of paradigms and epistemology as tools

You can see even on the quantity of pages in his “Opera”, how relevant the philosophical task for the understanding of the scientific position of Sechenov is - more than one third of the papers deals just with philosophy. More or less all problem oriented papers, especially “the reflexes of the brain” include relevant philosophical positions and new ideas. Sechenov developed within his life a more and more comprehensive philosophy based on a “physiological New-Kantian” paradigm and an extended epistemological work. So his position as one of the famous Russian natural philosophers is generally accepted.¹³ So he used in an early publication (1868) – according to the available data at this time – formulations which can be interpreted as a special “materialistic vitalism” in context of “living energy” - close to his teacher Müller.¹⁴ Then he attributed to the neuronal centres “abilities” which have been not usually attributed to physical energy.¹⁵ 1902 he formulated – again according to the new state of available data – differently: He explained the same phenomenon with a formulation which is much closer to an evolution based monistic materialism. (Opera, p.257 f).

Sechenov developed a complex and comprehensive proposal for correct scientific work. He accepted “Ignoramus” – “We do not know”. He used this formulation several times, but never in connection with “Ignorabimus”. He accepted the “unobservable” – including “unconscious” as matter of natural science (with regards to Helmholtz, The elements of thought, p. 472). And he introduced terms which “covered” the unobservable inner causes” according to the need to communicate the generalizable results of his studies (e.g. the “term “Ladung der Nervenzellen mit Energie” p. 258)

This confirms my analysis that Sechenov used not only epistemological techniques as tools, but paradigms too. Therefore paradigms are seen as changeable and adaptable. Paradigms and therefore the used ontology are never “given” frames, in which all data and thoughts must be integrated. Paradigms can and should shift – depending on the level of available data.

3.1.2. Sechenov – a precursor of a Relativity theory for Causal Connections?

Sechenov argued intensively with many fundamental epistemological problems. A paradigmatic but not often discussed contribution is his argumentation about “cause” and “causal connections” (Opera 473ff) including unobservable causes. So he discussed what is the active element (“starting point - cause”) of the falling of a stone, the braking of a dam etc., and that this can be seen as the/a passive part of the chain, too. He pointed out the relevance perception to define the active part – which would bring us to the wrong explanation to understand e.g. the falling of the stone, which is caused by unobservable power. He linked this with inner causes of men (e.g. passions as cause for misfortune) but with the clarification that “*the connections are not the same as on the phenomena of the outside world, but they have a common point...*”. But is there a general position about this “common point”? This could be seen as the starting point for a “Relativity theory for Causal Connections”. But it is a pity. He did not follow to the last steps. But he argued similar as we know from Einstein and his dilemma with the Relativity of movements.

But we should not forget that Sechenov worked about two generations before Einstein and had not the empirical data, which Einstein used as basis for his great theoretical work

Sechenov gives in the “elements of thought” (which can be seen as the second main work of Sechenov) a short summary of the “all existing theories” about “cause” and “causal connections” including the Kantian position, that the causal relationship is the first natural step toward the explanation of phenomena belonging

¹⁴ „Unter diesen Voraussetzungen würde das Geschäft der Nervenreizung nicht bloß in einer Erhöhung der Ladung der Nervenzellen mit lebendigen Kräften, sondern auch in einer Erhöhung der Erregungswiderstände bestehen“, in: Sechenov I.M. „Über die elektrische und chemische Reizung der sensiblen Rückenmarksnerven des Frosches, Graz 1868, reprint in „Opera“, p 193

¹⁵ „Dieser Fähigkeit liegt offenbar die Eigenschaft der Nervencentra zu Grunde, die ihnen zugetheilten Stöße eine Zeit lang in latenter Form zu conservieren.... bei bestimmten Reizstärken aber mit einer coordinierten Reihe von Bewegungen zu antworten“ detto, Opera. p 188, 189)

to the inborn capacities of the human mind and therefore with all its inborn limitations. He points out, that cause and causal connections are “ideas” (S 473), but very special ones:

- 1) *The ideas of cause and causal connection can be applied only to phenomena and to processes of chains (both objectives i.e. phenomena of external world, and subjectives, i.e. phenomena of the inner world of man); to successions but not to co-existences.*
- 2) *The cause is the active element of the phenomenon, and the causal connection is its relation to the secondary factors of the phenomenon; but this relation is peculiar: it is neither spatial nor quantitative, neither a similarity nor a relationship in time.*
- 3) *The causal relationship between the factors of the phenomenon is not directly accessible to our senses. It is reviled by the mind of the thinker”.*
- 4) *The causal relationship is the first natural step towards the explanation of phenomena [close to Kant, as the following too:]*
- 5) *The causal relationship as a form of perception of the connections of objects belongs (together with the perception of the connections of the objects according to similarity, sequence, and location in space)*

If this relationship is neither spatial nor quantitative, neither a similarity nor a relationship in time and of course it is not observable, then it is not to express with mass and movement (only). But exactly these are the characteristics which are used to build a frame of a coordinate system to characterize even spontaneous changing movement of an energetically characterized object. For the dealing with time, space and matter and their changing Einstein had to develop Relativity Theories to link Newton’s and Maxwell’s frames within one metatheory. In a monistic understanding it should be expected a need for a relativity theory of causal connections too.

And Sechenov point out in this chapter relevant aspects for such a generalizable understanding of cause and causal connection: He demonstrated on the example of the explanation of a stone the relativity of the cause (as the active part), the causal connection and the effect as the passive output. Depending on the used ontology the falling can be seen as the consequence of the attracting power of the earth, the connection in form of a one way. Physicists explain this different: They assume on the basis of Newtonian physics mutual interactions of two masses of different size. And since Einstein we know, that the same phenomenon can be explained with better correlation of the mathematical predictions with the observable phenomena with the assumption of fields based on the curvature of time space depending on the energy of the objects then with mutual interacting (linear) powers. A statement about the correctness of another statement about cause and causal connections and its output must integrate the ontological position used in the argumentation. Otherwise a distinction between cause and effect, and the type of causal connection (e.g. active or passive, linear – non linear, because of a power with effects over distances - because of obserability over distances ...) can not be controlled correct.

Sechenov did not discuss problems of cause as the active part, causal connection with the output as the passive part in connection with reflexes. If you use a definition of reflex according to the definition of the Functional Systems Theory in which a permanent flow between the perceptor and the analyzer is assumed, then we have a situation, in which it is depending on the position of the outside observer to start the description of the permanent flow with an perceptor which cause an effect for the analyzer. But the analyzer is at the same time a perceptor and therefore the cause for a chain of causal connections including such ones back to the perceptor (which is now an analyzer too). Therefore we can say that the causal connection between receptor/analyser or analyzer/receptor does not change in principle the distinction is only a consequence of the inborn category of causality – to see all in succession and non in co – existence.

If the assumption is correct that “cause and causal connections” are ideas to deal with the phenomena e.g. of the external reality, then the coordinate system we are using in our mind to characterize movement of perceived objects in time and space are just one of our “coordinate systems” human mind creates to deal with the given world. If the analysis of Sechenov is correct then we have to postulate other coordinate systems too, e.g. such a coordinate system to deal with causal connections and effects of their changing in the outer world as well as in the inner world. But some coordinates must be different from the e.g. Euclid’s room. Maybe we have to assume in principle similar constructions for a “room of values” etc. But there must be a linkages between the different types of coordinate systems: If we look at the language of bees, which can be expresse by movement of the body within the darkness the information about the “outside world”, then the relationships of objects within an Euclidic room can be transferred feeling these movements and – maybe with assistance of the taste - the information of the type of food. But both types must be linked

adequately so that the informed bees know what kind of food (= an information about a position within a “value grid”) can be collected at what place in the surrounding (= an information about a position within an “Euclidian grid”). Therefore cause and causal connection should be seen with regards to different coordinate systems – created in agreement – and the principles to create and to link them with the brain.

3.1.3. Sechenov and Einstein: “Theories deal not with actual realities but with potential realities” - “Theories are free inventions of the human mind”

Sechenov and Einstein came to very similar understanding about the nature of theories, but from totally different starting points:

Einstein started with the incompatibility of two indispensable theories according to the 3rd sentence of Aristotelian logic: The theory of Newton and the theory of Maxwell: A statement about the speed of e.g. a star can be only correct if the position of the observer of the star is integrated into the statement. (Newton). But a statement about the speed of the light of this star can only be correct if the speed of the observer is not integrated into the statement. (Maxwell). Both sentences are the total opposite of another. Therefore one of them must be wrong, one must be correct and there is no other solution – if we apply the Aristotelian principles. But both theories are indispensable. What should be done? This type of problems should be the starting point to develop a “real theory” according to Einstein. His answer was: This incompatibility is just an artefact because of the different views on the same reality. The reality is not incompatible with itself. It is only the way Newton and Maxwell have created their view about reality. And a view is all the time of a different nature than that for what the view stays. The relationship between the theory about (aspects of) reality and reality is similar as the relationship from a map to the landscape. But humans can have only views of the reality. Therefore it is allowed to create the view new. And this is the special challenge for the scientist: To create “a real theory” in such a way which is compatible with Newton and Maxwell, but as close to the phenomena as possible. Einstein understood science is the attempt to create explanations for the “output of the decisions which were made within the only evolutionary process”. Therefore we can decide between the different theoretically possible progresses if we look at the phenomena in our given world. The Relativity Theories were the result of this position.

The position of Einstein can be seen as an application of Kant’s view. Helmholtz and the other “physiological Neo-Kantians” came to the same conclusion even from another starting point: The (mind of the) person is creating the scientific views about the “outside” within the borderline of the morphological limitations of the sensory system and the brain: Therefore the theory must be “of a different nature than the observed given world”.

According to the nature of human physiology a human person has no other possibility to use the “given brain” which is a product of the evolutionary process then according to the limitations and possibilities which are the result of the “evolutionary process”. Therefore the applicability of this brain to use it for “idealistic conclusions” should be in agreement with the basics which Einstein could confirm for the very fundamental entities. Therefore the idealist Kant and the morphologist Helmholtz, but the materialist Einstein should come to the same basics. If Kant and Einstein are helpful for the understanding of “the given world” we should expect that the linkage between Kant to Einstein as well as the linkage between Kant and Helmholtz and Sechenov should be connectable to a circle within the argumentation of Kant, Einstein and Sechenov. So it is not a surprise that Sechenov has a very similar position as Einstein and created terms too, especially to link different evolutionary levels: e.g. “Capacity to act”, etc are terms which allow to understand the phenomena in such a complex real world. Therefore it is conclusive with the morphological and materialistic ontology of Sechenov when he pointed out: (The elements of thought, Opera, p 478): *“When the chemist discusses the structure of the bodies and introduces the notions of molecules and atoms etc. he is already operating mentally with extra-sensory objects. The molecules and atoms of the chemist are not actual realities, but inasmuch as they are deduced from experiments they are **“possible realities”**. The waves of light and ether are extra-sensory conceptions, but they are on the threshold of reality, i.e. they are **“possible realities”**”*. Einstein pointed out and formulated that *“theories and scientific terms are free inventions of the human mind”* but they have to be created in such a way that they are “