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I.M. Sechenov (1829 – 1905) and the Scientific Self-understanding for Medical Sciences

WALTER KOFLER

Department of Hygiene, Microbiology and Social Medicine, Division of Social Medicine, Medical University of Innsbruck, Austria

There is no discussion about the historic relevance of I. Sechenov for physiology and neurosciences as the "father of Russian modern physiology". But he is relevant for modern natural science too because of his basic epistemological and ontological work. He did not accept the up to now basic paradigm of "Ignorabimus" which can be seen as the reason to exclude even the generalizable aspects of individuality, creativity and spontaneity from natural science. He developed techniques for empirical based science to deal with materialistic and idealistic aspects of the comprehensive person the "ignoramus" according to the actual stay of knowledge and the acceptable ontologies. He demonstrated that ontologies ("paradigms") can be used as tools according to the given problem which should be solved. So Sechenov can be seen as a precursor of the so efficient philosophical positions of Einstein and Th. Kuhn. The stay of the art in physiology and neurosciences changed since the time of Sechenov dramatically. Therefore the philosophical positions of the 19th century should be discussed. Maybe this is indispensable for the needed linkage between materialistic and idealistic aspects of a person. For this the proposals of Sechenov are helpful up to now but nearly unknown.

There is no discussion about the historic relevance of I. Sechenov as the "father of Russian physiology." But he is relevant for modern natural science too because of his epistemological and ontological work. He did not accept the up to now basic paradigm of "Ignorabimus" that can be seen as the reason to exclude even the generalizable aspects of individuality, creativity, and spontaneity from natural science. He demonstrated that ontologies ("paradigms") and epistemology can be used as tools according to the given problem. So Sechenov can be seen as a precursor of the so efficient philosophical positions of Einstein and Th. Kuhn. The state of the art changed dramatically. Therefore, the philosophical positions of the nineteenth century should be questioned. Maybe this is indispensable for the needed link between materialistic and idealistic aspects of a person as a whole. In this respect the proposals of Sechenov are helpful for medical science in the twenty-first century too but nearly unknown.

Keywords Sechenov, medicine, epistemology, ontology, paradigm, ignorabimus, system theory, biopsychosocial model

Introduction

Ivan Michailovich Sechenov[1](1829 – 1905) is to be considered the father of Russian physiology. There is almost no branch of Russian physiology that has not been influenced by

[1]Another version of transformation of the Russian writing into Latin letters is "Setschenow." For example, his friend Ludwig used "Setschenow" in his letters.

Address correspondence to Univ. Prof. Dr. Walter Kofler, Medical University of Innsbruck, Division of Social Medicine, Department of Hygiene, Microbiology and Social Medicine, A- 6020 Innsbruck, Austria. E-mail: walter.kofler@i-med.ac.at

him. Even Pavlov declared that the "reflexes of the brain" was the starting point of his research, for instance, on conditioning. Today, many scientific schools refer to Sechenov, including those who are to some extent even in conflict with each other such as nervism[2] and electrophysiology or those who reject questions about the free will as unscientific (e.g., the behaviorists) and also those who do not consider questions regarding the basis of individuality, spontaneity, and self-determination as irrelevant (e.g., many representatives of the theory of functional systems). The historical significance of Sechenov was and is undisputed in the world. He did not receive the Nobel Prize maybe because he retired in the same year when the Nobel Prize was distributed for the first time (1901). But Nobel laureates confirmed his fundamental relevance. Thus Sherrington in his Nobel Prize lecture in 1932 drew attention to Sechenov as the first who gave proof of the central inhibitory effect. No other physiologist (except the unique Helmholtz) possessed such a wide range of scientific achievement (Timiriazev, 1935). Equally undisputed is also the fact that the sciences of physiology, psychology, and behavioral research have all developed far beyond him. Is Sechenov then to be considered and respected today as no more than a figure of history? The point that is made in this paper is that even to this day Sechenov´s ideas are topical, and paying attention to the fundamental principles formulated by him is possibly even more of relevance at the present time than ever before. This is because of his critical position to ontological and epistemological arguments.

Sechenov was born in 1829 in Teply Stan — a small place in Russia that is now named Sechenovo. After education and practice as military engineer in St. Petersburg and Kiev he studied medicine in Moscow (1850–1856). Then he went to Germany, Austria, and France as pupil and friend of the leading physiologists of his time (e.g., H. Müller, Cl.Bernard, Helmholtz, Emil Du Bois – Reymond, Ludwig). They taught him the most effective techniques for experimental research for nearly all fields of physiology. But they were involved into the philosophical quarrels of this time, too: So Helmholtz and Müller are counted to the founders of the Physiological Neokantianism. In 1860 he came back to Russia as professor in St. Petersburg and started with the implementation of all the different parts of modern physiology in Russia. In 1863 he published the world famous book *Reflexes of the Brain*. But without any scientifically or philosophically correct argumentation this book was the reason to be accused a propagator of immorality and nihilistic philosophy. He insisted in the priority of correct scientific argumentation. Therefore he had to change his working place several times. In 1891, he finally got the chair of physiology at Moscow University, where he retired 1901. He died in 1905 as a world famous scientist. I refer to the paper of Grigoriev and Grigoryan in this volume of the journal for further information about his life and his physiological research work. A good impression about the real situation is given by M. N. Shaternikov, a pupil and friend of Sechenov (Shaternikov, reprint 1968).

The Philosophical Positions of Sechenov

One has to deal with Sechenov's philosophical positions to valuate him adequately as scientist: Nearly one third of the pages in *The Selected Works* deal with them. *The Selected Works* (1935) is the compendium of his most relevant publications in German (as originally published) or English (originally published in Russian). All citations of pages in this paper refer to the reprint of 1968. But Sechenov did not consider himself a natural

[2]Nervism is a physiological position that intends to attribute as many functions to the nervous system as possible.

philosopher. It is relevant to understand that he insisted to be not a philosopher but just a correct working scientist. (e.g., "We are not philosophers and shall not enter into a discussion of these differences," Sechenov, 1863b, p. 264). But any scientist has the obligation to deal with his tools. And Sechenov accepted that "the theory defines what a scientist can observe" (as Einstein formulated in 1934). Therefore the scientist has to select the ontology[3] according to the given problem. And he accepted that the used ontology limits how he has to interpret his results. So it was for him a must to discuss all his tools: the technical as well as the philosophical tools. So the medical doctor working, for example, with an electron microscope has to understand his apparatus but not as a physicist. And it is not unusual that the consequence of such activities of a nonexpert can improve the state of knowledge even in physics. And he was so efficient doing this that finally he was counted to the most relevant natural philosophers (Lossky, 1951).

The Use of Ontology by Sechenov

His philosophical position about world views — as paradigms that can or cannot explain what is the objective nature of our universe and all objects — can be characterized as follows:

- He delegated the final answer about the ontology to the philosophers, even a special ontology is confirmed with laws as the doctrine of immortality of the Soul in Russia (Prince Urussov, cited in Shaternikov, 1935, p. xxiv) in the nineteenth century (e.g., Sechenov, 1863b, p. 264; Sechenov, 1903; in Shaternikov, 1935, p. xxv).
- But he pointed out why any physiological research work is based on ontology — even if the scientist is using ontology consciously or unconsciously: Ontology defines, what kind of questions can be asked, in which way we have to define, for example, what is the cause — what is the reaction, etc. (e.g., Sechenov, 1901, pp. 473). Therefore the scientist has to reflect about the view, which is the most appropriate to deal with a special scientific problem. Ontology can be used like a tool and opens possibilities but causes limitations for science too. But the scientific results influence the acceptable paradigms, too: They can falsify world views like spiritualism and the mechanistic view of Laplace.[4] This position is more basic then the position of Th. Kuhn.
- The used ontological position must be explained and discussed in connection with their possibilities and limitations like the possibilities and limitations of the study design, the used apparatus, etc. But there is only the need to deal with possible influences. If there are no influences to expect, then there is no need to discuss ontology and epistemology.[5] So he did not discuss philosophical problems in "pure" biochemical research work (e.g., see Sechenov, 1879), but he discussed them intensively in all contributions dealing with psycho-physiological topics.

These three aspects can be seen as revolutionary not only for the past but also for today: His ancestors (and many followers) accepted that any scientist has to accept a world view as an indispensable prerequisite for his scientific work. Now the position seems to be a dogmatic prerequisite to exclude any ontological assumptions from sciences

[3]Ontology: The branch of philosophy that deals with the nature of being.

[4]Laplace assumed that all past and future processes in this (mechanistic) universe can be calculated on the basis of natural laws. See the next section.

[5]Epistemology: The branch of philosophy that studies the nature of knowledge, its presuppositions and foundations and the principles to extend knowledge.

as "metaphysics," even their use as just a tool that can be changed according to the given research problem.

- He fought against dogmas in general, particularly in ontology, "which prevents us to pay attention to those links as the factors that determine the full"(Sechenov, 1895, p. 393).
- He deduced, why special philosophical offers for ontology are more or less helpful for natural sciences. So he excluded a very common paradigm of his century as incompatible with physiological science: the dualistic view of spiritualism. (e.g., Sechenov, 1873, p. 355) To contrast his position from spiritualism he formulated a materialistic monistic position: "Whenever man is spoken of as an indivisible totality, a unit, the word 'man' denotes the physical, material nature of man, and nothing else" (Sechenov, 1873 p. 354). But his position can be seen as neutral monism with a balance between material and idealistic aspects, too: "Shall we isolate the middle of an integrated whole, calling it psychical, and opposing it to the rest of the whole, calling it material?" (Sechenov, 1873, p. 349). This seems to be in contradiction to his common formulations, like "in our mind" or "with the body." But he points out that this is done just for the better understanding of his formulation. Such formulations should make it easier to understand. ("I have spoken … of psychical elements of the reflex process; but I had of course no intention whatever to separate the middle phase of a whole act from its beginning and end," Sechenov, 1873, p. 348.)
- In topics dealing with progresses he presented a monistic position that was extended by evolutionary aspects. His view of evolution covered material *and* immaterial aspects. ("Darwin's great theory of the evolution of species … necessitates the recognition, by the majority of naturalists, of the principle of evolution of psychical activities" (Sechenov, 1901, p. 410.) He characterized this evolutionary process as an interaction between the morphological and psychical development. ("…The next stage in the evolution of the senses may be defined as the coordination of the activity of the specialised organs of senses with each other and with the motor reactions of the body," Sechenov, 1901, p. 414.)
- He deduced the following conclusions:

> It becomes a logical necessity that the whole psychical life of man, being one of the results of the general process of evolution, should also develop from the sensory organisation of earlier stages. But the habit of seeing an abyss between the mental life of a man and animals is so strong that our thought involuntarily hesitates before accepting the existence of an evolutionary connection between them. (Sechenov, 1901, p. 415)

But this sentence is more radical: Sechenov covered with "earlier stages" even the stages of the evolution of inorganic matter, even science can not deal with them actually in an adequate way:

> But can human psychical phenomena be compared to anything? To ascend … to more complex phenomena is impossible; immediately below [the phenomena of human psychical phenomena] the unanalysable phenomena of psychical life of animals; and still below lies the sphere of inorganic matter. Is it impossible to compare psychical life with the life of rocks, plants and even of the human body? When the greatest thinkers of the past compared the physical and mental

> life of man, they usually found no affinities, but only differences. Indeed, early philosophers held the same views on the nature of psychical phenomena as do the vitalists in respect of the body. (Sechenov, 1873, p. 341)

But Sechenov would be misunderstood if "life of rocks" would be seen similar as the "Soul of crystal" of Haeckel. He used terms — as demonstrated above — often in a way that his message would be easier to "catch" for the reader. The monistic and evolutionary position is only conclusive if you accept "energetical" and "information-related" abilities as expressions of the unique essence even of the inorganic object but on a level that is depending on the stage of evolution. Therefore the level of "life of rocks" is not to compare with the life of plants, which is not to compare them of animals, which is lower then the level of humans. If Sechenov is calling this "essence of matter" (e.g., Sechenov, 1873, p. 353) then the term "matter" covers much more qualities as the term "matter" according to the understanding of a physicist and of a common materialistic position. His position is close to a "neutral monism" in which "materialistic" and "idealistic" abilities are reconciliations for each other.

Sechenov´s View of the Link between Epistemology and Ontology

The accepted view of the world defines what kind of scientific techniques ("epistemological tools") can be used. This explains why Sechenov focused on one hand the position that philosophers should develop their state of knowledge and physiologists should select what of it is helpful for the physiological application, but he has written at least one paper that deals exclusively with natural philosophy: "Impressions and reality." In the *Selected Works* no date of the publication is provided. But according to the content and the examples used (e.g., of the common use of the telephone) it was published after the "Ignorabimus-discussion"[6] (about 1895).

He starts with a position that can be attributed to Physiological Neokantianism: We have no other information about the objects of the external world then these that are impressions created on the basis of our sense organs by our brain. Philosophers would say "by mean of the sense organs we receive only a sort of explanatory legend of the outside world" (Sechenov, 1895, p. 393). "If the question [is our consciousness a mirror of the surrounding reality and to what extent] is put directly, i.e. if the external source is taken as the cause, and the impression as the effect, the problem appears to be insolvable" (Sechenov, 1895, p. 393). Then all information including all data of empirical science gives us no philosophical objective information about the outside world. This would confirm the position "Ignorabimus" —we do not know and we will never know it because of the nature of the person. But is this conclusion relevant for natural scientists? They are focussing not on philosophy but on applicable answers for daily life problems. They ask: "How is it possible to reconcile this seemingly conditional understanding of the external world with the advances in natural science which give man an ever-increasing power over the forces in nature. … So a contradiction between the basic impossibility to know the outside world and the practical achievements of science is well known to thinkers." Sechenov recommends the following compromises as reconciliation. "The knowledge of the external world may be unconditional if the laws of the mind on which our knowledge of the external world is based have the same roots as the laws of all that is and take place outside of us; or (at least!) if these laws stand in strict relationship with each other (p. 393)." This

[6]A strong discussion between natural scientists about the philosophical basis of their work: See the next section for more information.

allows the conclusion that it is not of relevance for a natural scientist that we can not know objectively what this world is. But it makes sense to create imaginations how it can be thought that all these phenomena and processes we are able to observe can be deduced from assumptions about that what could be outside of us.

There are two relevant conclusions:

a) The terms "to know" and "to explain" have therefore other contents for a natural scientist then for a philosopher or a lawyer who has to execute the doctrine of immortality of Soul. Protesting against the accusation that the "Reflexes of the brain" was an attempt to "explain spiritual activities of man by means of material principles," Sechenov has written: "The misinterpretation of my view is due to a wrong use of the word ´explanation´ by the layman: when the scientist discovers the same superficial analogy between a somatic process and an undoubtedly psychical act, the layman infers that the scientist is entirely reducing the psychical to the matter" (Sechenov, 1872, p. 115).
b) Therefore the position "Ignorabimus" does not make sense for a natural scientist. It is obviously a fact — in an objective understanding according to philosophy. The problem for the natural scientist is "Ignoramus — what we actually do not know" and to deal with it in a correct way.

Sechenov made an additional conclusion about the possibilities and limitations of natural sciences: Science should make our view about reality simpler (and ontology is understood as the most generalized simplification). Therefore, science is an invention about what (we assume) is real. Therefore, our terms are of another nature than that for what they are standing. Sechenov formulated this as follows: "When a 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 insomuch as they are deduced from experiments they are possible realities… The waves of light and ether are extra-sensory concepts, but they are on the threshold of reality, i.e. they are possible realities" (Sechenov, 1901, p. 478). These formulations could have been made by Einstein too (1949). Einstein deduced from similar positions "that any natural law and any scientific term is a free invention of the human mind" just so we can handle reality more appropriate. But he pointed out that these inventions are not totally "free" but have to be done in such a way that our models are in reconciliation to the phenomena (Einstein, 1934, p. 150–155).

Epistemological Tools of Sechenov

Sechenov developed different techniques to handle experiments in a correct way. Only one example will be explained here: How a scientist should deal with the given limitations on the state of knowledge, which is far away to allow to handle with the person as a whole, which means as an entity with bodily and mental abilities including its expression we are used to calling "free will."

He focussed on the evolutionary nature of the person. Therefore, the younger level must be based on the older one, but not in a reductionist way. But as long as not enough knowledge about the higher levels is available, the scientist has to discover the principles of the old. "Scientific psychology must be a series of theories concerning the origin of psychical processes" (Sechenov, in Shaternikov, 1935, p. XXIX).[7]

[7]Sechenov sees his position in good agreement with Spencer. He referred to him with his theory "to derive the evolution of various senses from a common primary form (Sechenov, 1901, p. 414)" and to assume "only on a quantitative difference between instinct and intellect (p. 415)".

But at any stage of knowledge it is only possible to explore the effects of the new on the use of the researchable old. And maybe — if more data about these connections are available — it will be possible to come to a model to deal with the new in principle. He applied this position on one of his focus points of research work: The function of the brain with respect to "inhibition" depending on its different evolutionary age. He accepted that the given knowledge did not allow the explanation of the nature of the intellectual activities. But it was possible to measure the influence, for example, of "free will" on the reflexes on basic physiological processes. So he designed a study to measure the influence of the will to suppress the basic reflex of withdrawing the hand from a solution of diluted acid if a ticklish person was asked to resist the reflex when he was intensively tickled. Applying this study design, he was able to confirm in a quantitative measure that — as predicted — the cortex can increase the inhibition more than by the influence of only older parts of the brain (Sechenov, 1863a, p. 171).

This study confirmed his basic assumption that the same biological basis is used in similar ways (by more and more complex and permanent active reflex systems that influence each other) to modify the physiological activities of only few muscles. But these changes allow them to express more and more high expressions of information according to the evolutionary level a living being has reached: "All the endless diversity of the external manifestations of the activity of the brain can be finally regarded as one phenomenon — that of muscular movement. Be it the child laughing at the sight of toys, or Garibaldi smiling when he is persecuted for his excessive love for his fatherland; a girl trembling at the first thought of love, or Newton enunciating universal laws and writing on paper, — everywhere the final manifestation is muscular movement" (Sechenov, 1863b, p. 264). He did not say, "All these movements are the same — nothing else than movement of muscles," as he was accused. What he wished to express was that the evolutionary process can use only that what is actually given. This is matter that can be moved. But the information that can be carried by the material processes can be more and more differentiated according to the emotional, cognitive, and intellectual level of the actor. And as he pointed out: "I wrote not only about reflexes which call forth movements, but also about reflexes ending in the inhibition of movements. The first correspond to the carrying out of good actions; the second — to the resistance of man to all impulses, including criminal ones. I did not think it necessary to discuss the problem of Good and Evil in my treatise; my object was to analyse actions in general" (Sechenov in Shaternikov, 1935, p. xxv).

The physiological principles that are used for these — and all other activities of daily life — can be characterized with the help of the Theory of Function Systems, created by his follower Anokhin and extended to a generally applicable theory by Sudakov and for a social physiology by Glazachev (Sudakov & Glazachev, 2002). The integration into a comprehensive model of a human as a social being and its interactions with and expectations on its environment can be done by the use of the "extended view," as described in the Sechenov Lecture 2004 (Kofler, 2005).

Inspirations for an Extended View on the Physiological Research Work of Sechenov

If we follow the recommendations of Sechenov, we should analyze his results (e.g., neurophysiologic) from the view that integrates the empirical results of the last 100 years. Just two examples for that will be given:

- Sechenov characterized the reflex as a process running between cells of a sensory organ and neurons (and its links to many other cells). From the evolutionary point

of view the cells of sensory organs are much older then the neurons especially in the cortex. The flow between them implicates that the neurons can deal with the information of the "older level" AND the "younger levels."

- Therefore, it is correct to assume that the ability to deal with information that can be attributed to a neuron (or any other actor) can cover more levels of evolution. Maybe this is the "missing link" demanded by Tress (1992) as the prerequisite to integrate the different levels of the hierarchical order within the organism of a human and of the person within societies and with his environment for the applicability of the system theory for a biopsychosocial model.
  - The "extended view" demonstrates that this principle can be used to answer former unsolvable questions (Kofler, 2004).
  - But this assumption also allows us to explain, for example, the placebo phenomenon (Kofler, 2006).
- Can "inhibition" of movement, which offers the possibility for modification, be understood as a principle not only for the evolution in living beings but in general too (e.g., to understand the evolutionary process from inflationary speed within the universe to speed of light)?

The Unexpected Late Consequences of the "Ignorabimus – dispute"

It seems relevant to remind basic positions of natural science in the nineteenth century and the consequences of their changing by the so-called "Ignorabimus- dispute" for the actual situation of medicine and natural science. Then it should be clear, why the understanding of Sechenov is such a rich source of inspiration for modern medicine and natural science.

At the beginning of the nineteenth century, there were two conflicting approaches, one the monistic, mechanistic, and atheistic world view, and the other a dualistic view accepted by Christian church and governments. According to the first view there is only an appearance of spontaneity and free will, but in the final analysis, even our mental processes are completely determined by factors that are as yet unknown. According to the other model ("Vitalism" or "Spiritualism") there is a fundamental difference between the two substances out of which the world is made namely, energy and matter on the one hand and the spirit on the other. Energy and matter were obeying the laws of physics and the spirit was assumed to be independent from these natural laws. But vitalism, as every other form of dualism, could be falsified by observed facts in the early nineteenth century such as those underlying the evolution theory. At the same time, the mechanistic world model (Laplace Model) was never in agreement to physics (e.g., with thermodynamics) and psychophysiology: Even the so-called "Laplace demon" — who, knowing all the natural laws, was able to calculate all the past and future changes of position of all natural objects and, consequently, was able to also predict all changes in positions in the brain — would still be unable to explain why, for instance, a specific light frequency is perceived as "green." Thus, this demon, despite knowledge of all physical and chemical processes in the brain, would not be able to know and to understand what a thought is (Du Bois-Reymond, 1872). So both leading ontologies were never able to cover all empirically enforced data. The discussion about the adequate ontology dominated the public discussion as everybody knows from the fight against Darwin's theory. But each scientist had to have ontology because of the law, which insisted in the "doctrine of immortal Soul" (Prince Urussov) that was understood as a confirmation of spiritualism. But spiritualism was falsified by empirical data. This was one side of the problem. The other problem was based on the assumption about basic differences in the power of sciences: At this time

scientists had good arguments that physics and chemistry would deal with theories, which allow objective predictions without any influence from any type of observer and research object, but all other sciences (biology, psychology, etc.) would only offer predictions influenced — more or less subjective — by observer and the nature of the research object. In this situation Emil Du Bois-Reymond offered a pragmatic solution that seemed to solve all problems (1872, 1880). He used the philosophy of Kant and its application on Physiological Neokantianism and explained that humans are a priori limited. Therefore, they would principally not be able to know different relevant aspects about nature. He called them "seven world mysteries." He assumed that four of them are in principle not to be solved with scientific methods even by the progress of knowledge: Ignorabimus, or we do not know and we will never know, the nature of matter and power, the origin of (spontaneous) movement, the origin of simple sensory perception and consciousness, and the freedom of will. The three questions, the answers to which are now unknown (Ignoramus) but that could perhaps be solved within the progress of science in the future, were: a)the origin of life, b)the obviously intentional and efficient orientation of natural processes, and c) the rational thinking and the origin of language. Therefore it would be useless to think about the — assumed as existing — unobservable qualities that are the basis for the processes underlying the "world mysteries." But it would be helpful to use unobservable qualities (like energy, forces, fields) to explain cause-effect chains for observable phenomena in physics and chemistry. Therefore, an additional definition of causality was needed: For these topics the scientific society accepted the closed chain of all phenomena as the confirmation of causality. And the society accepted to introduce terms instead of the characterization of each single step in the chain of unobservable causes and observable effects (which was and is needed in physics and chemistry). Such terms have to cover the chain of the unobservable causes (we will never know) and their observable effects with a social agreement about the content of one word (e.g., "conditioning or autopoiesis"). These agreements were not based on science. There are based on a world view, on ontology, and on social values!

Sechenov did accept "Ignoramus" and he accepted the technique of the "new causality." But he did not accept the relevance of philosophical argumentation of "Ignorabimus" and that philosophy and social values would be the basis for natural science — as demonstrated in "Impressions and reality" (Sechenov, 1895). But up to the present, scientists believe that the so-called positivistic position would be without ontology. What a misinterpretation!

At the beginning of the twentieth century Einstein falsified the first "Ignorabimus" with his discovery that the nature of matter and energy is the same. And Einstein could confirm that forces are just "free inventions of human mind" and, for example, gravitational force does not exist. Plank and the other quantum-physicists falsified that any individual process in physics can be predicted and physical processes would be independent from the influence of the observer. So the basis of "Ignorabimus" is never given. But up to now, natural scientists exclude the possibility to create assumptions about unobservable abilities to deal with information and to prove them in experiments as they do in physics.

The Potential of Sechenov for Medical Science in the Twenty-first Century

Sechenov used epistemology and especially ontology in an up-to-now unusual, but very effective, way: Similar as a "tool." I consider as a (scientific) tool all what a scientist can select from different possibilities to solve a problem. Typical is the choice between different "technical tools" (e.g., the scientist can select from different magnifiers and microscopes

to increase the observable differences of an object). But "the theory defines what we can observe," too. Therefore, not only do the technical tools define the possibilities we have to observe and to interpret the observed but also the decision for the theories used including their ontological and epistemological frames. If there are different possibilities of paradigms and epistemological offers between it is correct to select according to the needs of the given applied problem, then paradigms and epistemological techniques can be understood as tools too.

This may be an unusual position: In philosophy the paradigm is often understood as a position, on which all further arguments must be based. Such a paradigmatic position can be seen as the best and most comprehensive understanding about the nature of existence and must be the frame for all scientific arguments and the application of "technical tools." But natural scientists and medical scientists are not philosophers. They have to deal with applied problems that should be solved with the adequate and most economic techniques. And this must not be the most sophisticated technique. So for a special problem the use of a magnifier can be adequate. It would not be correct to conclude from the use of such a magnifier that the scientist does not know the existence of microscopes. This can be extended to the helpfulness of the different paradigms that were accepted over the centuries of science. From the philosophical position it was correct to ask for the most sophisticated/ideal answers in science and to exclude the existence of a *vis vitalis* and, therefore, vitalism. The conclusion from the empirical facts was a monistic position, especially a neutral and evolution based ontology. Therefore, it was conclusive for the philosopher to exclude unobservable psychical abilities from natural science but to accept further on the use of unobservable fields and powers. It would be conclusive too on the same level of argumentation to exclude the use of a water scale with the argument that we never accept the paradigm that the earth is a plate, or not to allow in scientific papers to speak of sunrise and sunset, because of the Copernican revolution. It should never be correct to speak about chemical and physical forces because of quantum theory and Relativity Theories. In all these topics a pragmatic agreement is used: To use this — even falsified — paradigm that allows handling an applied problem as simple as it is possible insofar as it does not cause incompatibility with the high sophisticated ontological position. But this agreement is not used in context with aspects dealing with information, psychic, or mental aspects. And without an equivalent level of argumentation on the biomedical- and psychosocial/valuation-based level it will never be possible to link both aspects of a person.

Sechenov has taken this position. He accepted the high sophisticated conclusion that science cannot offer objective answers. But he insisted on the practical relevance of science to solve applied problems. He clearly pointed out that spiritualism is logically unacceptable.

Conclusions

1. Modern scientists can learn from Sechenov and Einstein that it is helpful to assume that all natural laws and scientific terms are "free inventions of the human mind" just for better handling of reality. So terms should be created to deal with information related abilities, too. They should be characterized so that they can be empirically proved.
2. The distinction between physics and chemistry as sciences that offer results independently from the observer is falsified. Therefore the position of Sechenov with respect to ontology and epistemology should be accepted.
3. Modern scientists can learn from Sechenov to use ontology (and epistemology) consciously as tools and to select this paradigm out of the given ones that allows the most appropriate and effective solution of the given problem without incompatibility with

highest sophisticated ontology. This is a position that goes beyond the generally accepted position of Th. Kuhn (1962) that paradigms are only temporary limited views about the nature of the nature.

4. As long as it is not accepted to introduce terms that express abilities to deal with information we have to use a technique that was introduced in consequence of the "Ignorabimus-dispute": To make a social consent about terms that cover the unobservable cause, the process and the result with one word (e.g., the term "autopoiesis"). Such terms are of relatively low power. They are only to accept as long as there are not enough empirical data to create a model that allows description of all steps of a cause — response chain similar as in physics and chemistry.
5. If we would accept this position even for information and valuation-related aspects then medical science would have a chance to link biomedical and psychosocial aspects. The inadequate integration of them was the key argument of Engel in his paradigmatic paper in *Science* when he deduced why biomedicine *was* a science, but has now the status of dogma. (Engel, 1977, p. 130). The position of Sechenov would allow us to deal more appropriately with the requirements for a Biopsychosocial Model that Engel has proposed as a blueprint on the basis of General Systems Theory (Bertalanffy, 1968). But this proposal could not be realized because of ontological and epistemological reasons (Tress & Junkert, 1992). The key problem was the missing linkage in the terminology of the different disciplines. But this links exist in nature — as Sechenov demonstrated. We should start to create terms with regard to reality even to deal with the ability to link differences of matter with information and for the transfer of information.
6. This would allow us to extend our interest on scientific models: Medicine has to serve individuals but the given scientific frames are based on that what is generalizable from large numbers. The common problem of a medical doctor deals with individuals acting within this frame. We need theories to handle this topic correctly. Sechenov has demonstrated that this can be done in a scientific way.
7. A consequence of the self-restrictions in consequence of the lack of assumptions about abilities to deal with information (on a monistic basis of course) was that our theories focus on the principles for repeated activities. But there must be generalizable principles to deal with the new, to distinguish between the possible relevant from the irrelevant, and to integrate the new and, for example, spontaneity into the common, too. Sechenov focussed on that too.
8. Sechenov demonstrated that a monistic and evolution-based view of a unique person with bodily, psychic, cultural, economical, etc. abilities is helpful to deal with health and illness.
9. From this point of view the principle of reflexes — understood as permanent interactions between actors on different levels that are able to deal with the flow of information according to intentions based on different levels of evolution — gives the hope to create models for a better understanding of the person and his/her health processes.

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