Research & Reviews: Journal of Educational Studies

The Concepts in Experimental Observation and The Work of the Scientific Claude Bernard

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Review Article

Received date: 24/09/2016
Accepted date: 21/10/2016
Published date: 28/10/2016

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Keywords: Scientific Methodology, Observation, Experimentation, Claude Bernard

ABSTRACT

In this article we carry out a methodological reflection which is diving in the thought and work of the scientist Claude Bernard, researcher recognized universal prestige and has made a brilliant intellectual contribution to the field of experimental research from the field of medicine, always putting us at the time and when he developed his scientific activity. And we do making a parallel between what carries scientific observational practice and experimental, trying to radiate his thought to all those concerned professionals and occupied by the knowledge and application of the various methodological techniques century and a half after the lived time by Bernard.

During the decades of the 80s and 90s of the twentieth century there was a great explosion of educational projects in the field of social science research for access to places of tenured professors at the University, where, in most of them, it was difficult not find a brief reference, methodological issues when it came to the work Introduction to the study of Experimental Medicine physician and researcher Claude Bernard. We had the opportunity to meet an original of his first editions in the library of the University of Gerona donated by the philosopher of science José Ferrater Mora since then we moved the intellectual curiosity to know and analyze the work. Lately Critics editorial published jointly with Iberdrola Foundation, under the generic title Classics of Science and Technology and directed by Professor of History of Science at the Autonomous University of Madrid, Jose Manuel Sánchez Ron, it has echoed the aforementioned work, with titles as eloquent as the scientific canon, Exhibition system in the world, Foundations of a general theory of sets, the theory of evolution of species, Lectures on the development of mathematics in the nineteenth century, La controversy over the invention of calculus.

We understand that every researcher must set up a professional personality established around the benefits of science and its methodology, essential to create a style of thought and action that can be transmitted to students and training field element without which you cannot educate intelligent, creative and free minds. In that sense, we provide some ideas on scientific methodology in chronological origin from a brief analysis of the educational contribution of scientific Claude Bernard, trying to converge the interest of the author of this article, such as medicine and methodology [1].

Undoubtedly, one of the major influences that have occurred in the field of science and research has been the physician Claude Bernard through his work, repeat, Introduction to the Study of Experimental Medicine, published for almost a century and a half in 1865. Bernard has been considered one of the most important scientists of all time thanks to his contributions to physiology which as we know studies the functions of organic beings gathering in this form of study the principles of the exact sciences giving meaning to those interactions of the basic elements of a living being with its environment and explaining why each different situation where they can find these items.

They say that has not written anything brighter, fuller and deeper on the true principles of the art of experimentation; so that Bernard has been considered the most modern in the life sciences methodologist.

The nineteenth century was unparalleled for science period, and the work of this doctor, a "monument in honor of the method which has been the physical and chemical sciences since Galileo and Newton and Claude Bernard strive to introduce in physiology and pathology. The influence exerted on medical sciences, teaching, progress, including their language, will be immense; could not specify from this, "said Pasteur at that time.

The introduction to the book begins with a sentence, which is to "maintain health and cure diseases: such is the problem that medicine has proposed since its inception and whose scientific solution from the beginning, still haunts".

"It's still early nineteenth century, the life sciences were torn between the growing influence of chemistry and physics, a strong dependence of anatomy, persistent descent of teleology of Galen and metaphysical search for the essence of the lifetime. The second revolution was carried out quickly, in the middle of that century, when the cell theories are conceived, physiological chemistry and evolution.

This nineteenth-century revolution took advantage, largely, the systematic application of the concept of biological determinism, a process in which the ideas of Claude Bernard were very representative ".

Personal and Professional Background of Bernard

Born near Lyon, Bernard had a very tight primary and vocational training, being his first literary ambitions type, with little success, in the theater. But before his literary forays, he worked as a young man of a pharmacist, marking its introduction in experimental research, first preparing bitumen and then with the preparation of the triaca, a cure-all honorably pharmaceutical history, whose composition included about sixty ingredients. In literary circles of the time, both he liked to frequent, he heard the verdict: "you have worked in a pharmacy, then study medicine. You lack dramatic temperament for "author. This leads him to change course, take the advice and walk in another direction. He had received a good secondary education, and, as a result, sought income, using teaching as a professor of natural history at a women's college. It was introduced, however, in the academic world by joining the School of Medicine of Paris in the autumn of 1834. For his manual dexterity, Bernard was more interested in the dissection than rote, so their instructors did not have a high opinion of his abilities; however, to get a square external student, he could spend a long time going to the dissecting rooms and hospitals. When Bernard began his training in physiology, he found a discipline seething; attended classes at the Sorbonne where he "learned chemistry and blood sugar, blood role in breathing and digestive role of saliva, gastric juice, bile and alkyl; and most importantly for the immediate future of Bernard, digestion is the most accessible to chemical function. Later, as a student intern, he got a position that allowed him to complete four years of attendance at hospitals in Paris. He did not find the expected environment, and given their sense of dignity, bad manners teacher must have seemed especially offensive. He spent the years, wrote, Twenty-five years at the beginning of my career as a physiologist, tried ago, and I think that was one of the first, bring experimentation to the same internal environment of the body, in order to follow step by step and experimentally, all the transformations of various compounds chemical explained theoretically. In 1843 he published his first work on your attitude and is clear: the utility should have for clinical findings established in the laboratory. However, his first publications are a failure from the point of view that most interests the man of science, the truth. In 1844, he started its activity as an independent researcher, also in principle with little success, which led him to consider leaving his scientific career and return to his homeland as a country doctor; to do the little encouragement he supposed his family life was added: At this time, and in order to increase revenue, performed anatomical dissections to be drawn and included in an anatomical atlas, which was several times reprinted and translated into several languages [2].

However, its essential dedication remained that of experiments, he an experimental subject. He was on the right track. Biology Society considered as the most suitable for their scientific communications environment. The final takeoff of experiments Bernard is produced with his studies on the liver (hepatic gluconeogenesis), as well as poisons (curare and carbon monoxide), ending in 1851 with the discovery of vasomotor nerves, receiving the award Academy of Experimental Physiology in 1853 for his work on the sympathetic nerve. It was the fourth and last received this award, because, once entered the Academy, he was appointed chairman of the awards committee, which did not return to be candidate. "In 1850, the prestige of Bernard was fully consolidated many American doctors, who completed their training in hospitals and laboratories in Europe, flocked to his classes show and its laboratory, referring to his country laudatory reports Bernard". Before any discussion with his contemporaries replied: why believe this or that when you can experience? The prestige reached was inevitable entry into the Academy of Sciences in 1854 and that same year held a professorship at the newly created Faculty of Medicine at the Sorbonne. Classes, where used, with great precision, in medical language were published, becoming a serious enthusiast lecturer, direct and uncompromising rhetoric or the picturesque description, and anxious to present to his hearers only the facts in which he was interested; however, the great value of his lectures was to the vision offered mindset and work Bernard.

By 1860 his health began to suffer, probably because of the unsanitary conditions of the laboratory. Moreover, he never felt comfortable in the Imperial Academy of Medicine. He disliked the pomposity that seemed characteristic of members of the medical profession. He continued to publish, and after his death, all his articles were published in book form. Before that, he lived times of great pomp and personally conveyed to Napoleon: it was a great scientist and would like to do something in your favor.

The moment of greatest splendor caught on August 21, 1865, when at the Academy of Sciences presented its newly published Introduction to the Study of Experimental Medicine. He was fifty-two years, and its importance was immediately recognized. He was appointed senator. Bernard had little faith in the medicine of his time and preferred to rely on nature alone. He had dedicated his life to experimental research and to be forced, ill, to renounce completely the scientific world such melancholy reflected in his letters that alarmed his friends. However, having overcome the physical difficulties, he was able to resume scientific activity, so

that during the last six years of his life was so fruitful productivity twenty-five years ago, with many distinguished disciples. He died on February 10, 1879, remembering, by the Congress of Deputies, holding a state funeral, an honor never before been rendered to a scientist.

He lived the outbreak of war between France and Prussia and is about war as we want to finish this quickly, and somewhat accelerated reference to the life of Bernard, as deploring that science had not come to light the world and prevent war among nations, and although he did not believe that his country was responsible for the war had just happened, he believed that he had lost by the lack of scientific sense of the masses, and because he had not come to understand that and it was necessary treat many policies same manner appropriate to solve the problems of science issues.

The Introduction to the Study of Experimental Medicine as shown in **Table 1**, a masterpiece of Bernard, and motivates the development of this reflection is structured, in general, in the following sections:

Table 1. Study of Experimental Medicine

Part One	The Experimental Reasoning
First Chapter	Observation and experiment
Chapter Two	The idea a priori and experimental reasoning doubt
Second Part	Experimentation of Beings Vivienntes
First Chapter	Common to living beings experimental considerations and gross bodies
Chapter Two	Experimental considerations living beings
Part Three	Applications of Experimental Method to the Study of Life Phenomena
First Chapter	Examples of physiological experimental research
Chapter Two	Examples of physiological experimental research
Chapter Three	Research and criticism applied to experimental medicine
Chapter Fourth	philosophical obstacles that experimental medicine

Logically, our interest leads us to reflect on the contribution that Bernard done in the first part, essentially in the first chapter: From experimental reasoning. And we do it with references and direct quotations from his work (regardless of whether it entre comillamos or not).

Bernard understood that man cannot observe the phenomena that surround only in very narrow limits; the largest number of them escapes his senses and not just simple observation. For this reason there is a necessary gradation between the various investigative procedures, which can be simple and complex.

But man is not limited just to see; thinks and wants to know the significance of the phenomena whose existence has revealed observation. So he reasons, compares the facts, questions, and answers reaching contrasted with each other: this kind of contrast or verification by reasoning constitutes the experiment, only means that we have to teach us about the nature of things that are beyond us. In philosophical sense, observation and experiment shows instruct [3].

Different Definitions of Observation and Experiment

States that, sometimes, we have tried to confuse the experience (experiment) with observation, and refers to Bacon when he says "observation and experience, to gather materials; induction and deduction, to develop them; here are the only good intellectual Machines".

However, most scholars have distinguished the observation of the experiment, but have not been fully agree on the definition of these two terms.

Expressed as follows "an experiment differs from an observation that knowledge that gives us an observation seems to present itself, while that of an experiment is the result of any attempt that is made with the desire to know whether something is or is not". This definition is a fairly widespread opinion. According to her, the observation would be the finding or checking things and phenomena as we offer them the nature, while the experiment would be the observation of phenomena created or determined by the experimenter, which is establishing a kind opposition between the observer and experimenter: the first, passive in producing phenomena; and second, taking, on the contrary, a direct and active in the production of phenomena. "The observer listens to nature; the experimenter questions and forces revealed.

At first glance, this distinction seems clear and easy to understand. But by delving into experimental practice, it is found

that, in many cases, this separation is very difficult to do, and in the view of Bernard, drags the darkness has confused the art of research, which investigates and records the facts, with the art of reasoning, which puts into play logically to the inquisition of truth. In research there may be, at the same time, activity of the mind and the senses, either to make comments, either for experiments. Indeed, if to admit that observation is characterized by the mere fact that the wise man observes phenomena that nature has occurred spontaneously and without their intervention, could, however, find that the spirit, like the hand, always remains inactive in observation, and come to distinguish, under this concept, two kinds of observation: a passive, other active. Could be multiplied to infinity appointments of this kind to prove that, in the assertion of natural phenomena that are offered to us, the spirit is passive as soon as soon active; which means, in other words, that observation is both without preconceived ideas or by chance, as with a preconceived idea, that is, intended to check the accuracy of an idea of the spirit.

Acquire rely on experience and observation, it is not the same as doing experiments and observations

The above definitions have been made regardless while the observation and experience as the two extreme terms of experimental reasoning. We also observed in these definitions, lack of clarity and generalization. Create Bernard to give the definition all its usefulness and its full value is necessary to distinguish what belongs to the inquiry procedure used to obtain the facts, what belongs to the intellectual process that puts into action and makes them, while , the fulcrum and the criteria of the experimental method. The word observation is singular; in its general and abstract sense, it means the exact check a fact with the help of media research and studies appropriate to this test. By extension and in a particular sense, it has also given the name of observations on the facts found, and in this sense, medical, astronomical observations say.

When you are talking in a certain way and when it is said to experiments or make observations, it means to do research or inquisition, which tests are attempted, with the aim of apprehending facts of the spirit, through reasoning, may draw knowledge or instruction.

When speaking in an abstract way, and when it is said to rely on observation and acquire the experience, it means that observation is the fulcrum of the spirit reasoning, and experience the fulcrum of talent concludes, or better still, the point of reasoning perfectly applied to the interpretation of the facts. It follows that you can gain experience without making experiments, as it is conveniently reasons on well-established facts, as to do experiments and observations without gaining experience, if we confine ourselves to only record the facts. Observation is, therefore showing the facts [2]. The experiment is the one that teaches facts and gives experience relatively to one thing. "The man corrects experience every day. But it is because what reasons experimentally observed; without this requirement is never corrected. The experimental method does nothing more than make a judgment on the facts around us, with the help of a criteria which is not in itself but another fact arranged to check the judgment and give the experience. Taken in this general sense, the experiment is the only source of human knowledge. The spirit is nothing more than the feeling of a necessary relation between things, but cannot know how this relationship but for the experiment.

Therefore, we must consider two aspects in experimental medicine:

a) The art of getting accurate facts through rigorous research

b) The art work put in by an experimental reasoning, in order to emphasize the knowledge of the law of phenomena.

But, outside of experimental reasoning, no longer exist observation and experience, in the abstract sense above; There one as in the other facts but trying to be prepared by procedures accurate and rigorous research. The researcher must be both observer and experimenter good time, not according to whether active or passive in the production of the phenomenon, but as they hold or not on them to overpower. The art of scientific research is the cornerstone of all experimental sciences. If the facts underlying the reasoning are ill-established or erroneous everything will collapse or everything will be false for this reason often errors in scientific theories origin recognized by factual errors.

In research there are only facts brought to light by the researcher and tested as rigorously as possible by the most appropriate means. It is unnecessary to distinguish here the observer experimenter, by the nature of the investigation procedures implemented. The observer and experimenter are researchers who seek to check the facts as best as possible, and employ, for this purpose, means more or less complicated study, depending on the complexity of the phenomena studied. Each science research has a genre of its own and an arsenal of instruments and special procedures. It is distinguished by the nature of their problems and the diversity of the phenomena studied [4].

All progress of experimental science is measured by means perfecting their research. In scientific research, minor procedures are of the utmost importance. Each view that a new medium arise insurance and experimental analysis, science is making progress on the issues that this medium can be applied. Ultimately, the greatest scientific truths are rooted in details of experimental research, which are, in some way, the soil in which the truths are developed. Bernard says that must have gone to laboratories for all well understand the importance of every detail of the investigation procedures, which are too often ignored or despised by the false sages who are called generalizing. And he continues writing has been said by some that true science should be compared to a flowery and delicious plain, which could not be reached but after climbing craggy slopes and feet have broken through the weeds and thorns. If I were necessary to give a lecture to express my feeling about the science of life, I would say that

is a superb lounge all resplendent light, which cannot penetrate but through a long and ugly kitchen.

Observer and Experimenter Science of Observation and Experimentation

Where the distinction is between the observer and experimenter? The opinion of Bernard is clear: the name observer who applied research procedures, simple or complicated, the study of phenomena that do not need to vary is given, and who collects them, consequently, just as nature offers. It is called experimenter who uses investigative procedures, simple or complicated, to vary or modify a target anyone, natural phenomena and make them appear in circumstances or conditions in which nature never presents. In this regard, the observation is a natural phenomenon research and experimentation is the investigation of a phenomenon modified by the investigator.

We have said that, under the terms of experimental reasoning, observation and experiment names, taken in the abstract sense, mean, the first action to state a fact; the second, checking an idea for granted.

But if we look only observation in this abstract sense, it would be possible to find a science of observation. The mere statement of facts could never come to constitute a science. Well would multiply the facts or observations, but this little teach for learning; it is necessary to reason about what is observed, compare the facts and judge them by other facts that serve as comparison. But one observation may serve as a comparison to another observation, so that a science of observation is simply a science made observations, a science in which he will reason with experiments, in which he will reason about facts experimental obtained under the conditions that the experimenter has created and determined by itself.

It should be added that all sciences start out as pure observation, and only advanced in the analysis of experimental phenomena can be made; because the observer, becoming experimenter, imagines screening procedures to penetrate the human body and to vary the conditions of phenomena. Experimentation is merely investigative procedures that are unique to the experimenter, put into action.

However, in terms of experimental reasoning, it will be absolutely the same in the sciences of observation and experimental sciences. It will occur always judging by comparison, based on the facts, one that serves as a starting point, and one that serves as a conclusion to reasoning. Only we must clarify that science observation two facts will always be comments, while in the experimental sciences the two facts may be started experimentation exclusively or experimentation and observation at a time, depending on the case and according to it penetrates more or less deeply in the experimental analysis [5].

From a philosophical point of view, there is no essential difference between the sciences of observation and experimental sciences; there is, however, real and effective under the terms of the practical consequences that man can get, and relatively to the power acquired through it. In the sciences of observation and reasoning man observed experimentally, but not experience and in this sense you could say that a science of observation is a passive science. In science experimental man observed, but can work on the subject, it analyzes the properties and causes their own profit the appearance of phenomena that undoubtedly always happen according to natural laws, but under conditions that nature is not they had been made yet. Through active experimental sciences man becomes inventor of phenomena, a real foreman of creation; and could not, under this concept, assign limits to the power that you can purchase on nature, future progress of experimental science. There remains the question of whether the medicine should be a science of observation or become experimental science, although undoubtedly must begin by being merely a clinical observation. Bernard simply medicine is intended to be an experimental and progressive science.

The Experiment is not, at Heart, rather than an Observation

Despite the important difference between science calls observation and calls experimentation, the observer and experimenter have in their investigations, the common object and immediately establish and tell the facts or phenomena as rigorously as possible and in the most appropriate means; absolutely behave as if they were ordinary observations. Indeed, in both cases it is a fact checking; the only difference is that the fact that the experimenter should be noted, having not filed in nature, should it appear, that is, causes it for a particular reason and with a particular object. From this it follows that the experiment is nothing more than an observation caused with any object. In the experimental method, research is always accompanied by reasoning.

Important to remember that, to test an idea it is not always absolutely necessary to make itself an experiment or observation; It is necessary to resort to the experiment when the observation that there should be caused not prepared completely in nature. But if already made an observation, be natural, be accidentally, whether by another researcher, is going to have done already and is invoked simply to serve checking the experimental idea; in this case, the experiment is nothing more than an observation invoked as an object of verification. Where is that to reason experimentally necessary, as a rule have some ideas and invoke or cause, immediately, facts i.e observations to check this preconception.

There are cases that experienced no previous idea to check; no clutch, experimentation, in this case, is no less bound to provoke an observation: only the causes in order to find an idea that prompted the further way forward in the investigation, you can say, well, the experiment is an observation provoked in order to give birth to an idea. In short, the researcher finds and concludes; It comprising the observer and experimenter, pursuing the discovery of new ideas at the same time looking for the facts to draw a conclusion or own experiment to test other ideas.

In general and abstract sense, the experimenter is one that invokes or causes, under certain conditions, to take observation made teaching you want i.e. experience. The observer is one who gets the facts of observation and judging whether they are well established and tested with the help of suitable means. Without this, the conclusions based on these facts would be without solid foundation. For this reason the experimenter should be, at the same time, good observer, and the experimental method, experience and reason always go hand in hand.

Experimental Reasoning, the Experimenter does not Separate from the Observation

Bernard said that the sage who wants to embrace all the principles of the experimental method, you must complete two orders of conditions and possess two qualities of mind that are essential to achieve your goal and reach the discovery of truth. Certainly you should have an idea, submitting to verification of the facts; but at the same time ensuring that the facts serve as a starting point or to check your idea, they are well established and are fair; this is why it should be at the same time observer and experimenter.

The observer does contain pure and simply the phenomenon with sight. You must have no other care to guard against errors of observation that could make him look bad incompletely or define a phenomenon. The observer must be a photographer of phenomena; observation must accurately represent nature. It should be noted without preconception; the mind of the observer must be passive; listens to nature and writes as she dictates.

But once it verified the fact and well observed the phenomenon, born the idea, reasoning intervenes and the experimenter appears to interpret the phenomenon [3].

The experimenter is one who, under more or less likely interpretation of the observed phenomena, establishes the experiment so that, in the logical order of their projections, provide a result that provide evidence to the hypothesis or preconceived idea. For this, the experimenter reflects, tests, gropes, compares and combines for the lowest own to achieve the object proposed experimental conditions. We must all point to experiment with preconceived idea. The mood of the experimenter should be active; You must interrogate the nature and propose questions in every way, according to various hypotheses that suggest it. But once instituted the conditions of the experiment and work put in by the preconception or early point of view of mind, this (experiment) will be an observation provoked or premeditated.

From the moment the result of the experiment is manifested, the experimenter is opposite a true observation that has caused and must be checked, as all observation, without any preconceived idea. At this time, the experimenter disappear, or rather, become an observer; only when you have verified the results of the experiment, absolutely like those of an ordinary observation, his spirit was remade to reason, compare and judge whether the experimental hypothesis is proven or denied by the same results.

The experimenter should not be present in your imagination the idea, but as a means to request a response to nature. But you must submit his idea to nature and be ready to abandon, modify or change, as the observation of the phenomena he has caused, teach [6].

There are therefore two operations to be considered in an experiment. The first is to premeditate the conditions of the experiment before performing; the second is to check the results of the experiment.

It could also distinguish and separate the experimenter who premeditated and establishes the experiment, which carried out the execution and checks the results. In the first case, it is the spirit of scientific inventor who works; in the second, are the senses that observed and checked.

Which has condemned the use of assumptions and preconceptions in the experimental method, they have confused, necessarily, the invention of the experiment with checking the facts.

The idea is the principle of all reasoning and all invention, and it corresponds to every kind of initiative. According to Bernard, the whole wise embraces both theory and experimental practice:

1. Check a fact

2. Regarding this fact, born in his mind an idea

3. In view of the reasons idea instituting an experiment imagines and performs the material conditions

From this experiment are new phenomena which must be observed, and so on.

The experimental reasoning is precisely the reverse of scholastic reasoning. Scholasticism always want a fixed point of departure and undoubted, and could not find or external things, nor in reason, takes an irrational any source; as a revelation, a tradition or a conventional or arbitrary authority.

The experimenter, by contrast, never admits starting point immutable; its principle is a postulate, which follows logically all

the consequences, but never regard it as absolute and outside attacks experiment.

Systematic or scholastic reasoning is natural to inexperienced and proud spirit; only by the deep experimental study of nature it comes to acquire the dubious talent of the experimenter.

When Descartes part of the universal doubt and rejects the authority, it gives the most practical precepts for the experimenter who gives Bacon for induction. Indeed, only doubt it causes the experiment, which is finally determines the shape of experimental reasoning [7].

From the Beginning of the Experimental Approach and the Principle of Proof and Disproof

The experimenter should doubt his feeling, the idea a priori or theory that serves as a starting point; for this reason is absolute precept always submit your idea to the experimental criterion to appraise its value, considering that the experimental method the only real criterion is the reason. Science rejects the indeterminate, as in medicine are to form opinions about the medical tact, on inspiration or on a more or less vague intuition of things, it is out of science and example of medicine fantasy is given which can offer the greatest dangers leaving health and life of patients to the whims of an ignorant inspired. True science teaches doubt and refrains from ignorance. Moreover, contraprueba becomes essential and necessary for the completion of experimental reasoning character. It is the expression of philosophical doubt carried as far as possible; contraprueba is that judges whether the relationship of cause and effect sought in the phenomena have been found. For this, the contraprueba suppresses the cause admitted to see if the effect persists, relying on ancient and truly absolute adage: Sublata cause, tollitur effectus. It is what is still called the experimental crisis. All natural philosophy is summed up in this: to know the law of phenomena. All the experimental problem is reduced to anticipate and address the phenomena; but this double object cannot be achieved in living bodies but by certain essential principles experimental aspects on which treats the rest of the work [8]. In short, said the philosopher Henri Bergson (1859-1941), referring to the work that commented "It is for us something like it was for the seventeenth and eighteenth centuries the Discourse on Method".

The main reason for the enduring interest achieved by the introduction can be found in the author drew from his own experiments and countless basic and general ideas of his philosophy; also, that although his experiments referred to as reference examples, Bernard avoided the details, which surely would have distracted attention from the general principles. But perhaps the best summary of the Introduction was made by Emile Zola at the beginning of the experimental novel "Claude Bernard states, first, the differences between the sciences of observation and sciences experimentation. It comes to the conclusion that experimentation at bottom is nothing more than an observation provoked. All experimental reasoning is based on doubt just accept the phenomena that occur when tested.

The work, no doubt, to be clearly understood, must be situated within the context of the time; from then until the present date, the philosophy of science and scientific knowledge has advanced considerably, which can lead us to underestimate, if not ignore, the real breakthrough that led to the work of Bernard.

The book ends as follows: "It is therefore important and necessary care in education that knowledge should build intelligence not overwhelmed by their weight, and that the rules are designed to support the weak side of the spirit not drown or atrophy powerful and fruitful [9]. I should not enter here into other considerations; I have had to limit myself to protect the biological sciences and experimental medicine against the exaggerations of scholarship and against the invasion and domination of the systems, because these sciences, submitting those would disappear fertility and lose independence and freedom of spirit, always be the essential conditions for the progress of all mankind".

In short, we add, the experimental medicine does not respond to any medical doctrine or any philosophical system. Such a conception of the physiological system, Bernard established on theoretical grounds and well developed practices.

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