

Editorial

## Medicine and the machine

### *La medicina y las máquinas*

#### Medicine from ‘art’ to ‘science’

Medicine, that for centuries had qualified itself as an *art*, is considered (and considers itself) today as a *science*. If examined carefully, this does not appear as a deep change, for the old term “art” had a meaning quite different from the meaning it has assumed after the romantic turn of the nineteenth century, when art in general, and the single arts in particular, were considered eminently as activities having to do with the production of something *beautiful*. Actually, the ancient Greek term which is translated as “art” (even today) is *techne*, and by this term the ancient philosophers denoted an activity able to produce excellent results and at the same time grounded on the knowledge of the *reasons* for such an efficacy. In other words, an art consisted in a practical ability supported by theoretical knowledge, and it is not by chance that the ancient philosophers usually give, as an example of art, precisely medicine. This meaning of *techne* passed unchanged to its Latin translation as *ars*, and then to the corresponding words in modern languages.

As a consequence of the new ‘aesthetic’ meaning assumed by the notion of art in the nineteenth century, and also due to the extraordinary intellectual and social prestige acquired in the same historical period by the natural sciences, medicine too began to cultivate the proposal of qualifying itself as a *science*. The realization of this proposal presented three fundamental aspects. The first was the adoption of the *results* obtained by the natural sciences as a theoretical and practical support for the medical knowledge and its application in diagnosis and therapies. The use of measuring instruments, of laboratory tests, of anatomic and physiological examinations, of bacteriological knowledge, began to replace or to help the confidence in the “clinical eye” of the doctor in the treatment of single diseases.

The second aspect was a refinement of the *empirical* side of medicine, whose first elements in the West were already present in the Hippocratic tradition and had been gradually increased and identified along the centuries, until the more formal codifications of the nosographic classifications and their criteria elaborated in the first decades of the nineteenth century.

A third step was accomplished in the second half of the nineteenth century when the requirement was put forwards that medicine, in order to be genuinely 'scientific', had to adopt the characteristic method of the natural sciences, that is, the *experimental method*. The work in which this additional requirement is strongly and clearly advocated is the *Introduction to Experimental Medicine* by Claude Bernard (1862). In that book the issue of what was later called 'clinical experimentation' is not yet envisaged since neither patients nor volunteering human beings are considered as objects of experimental investigation, whereas animals are. It is known that precisely this extension to humans of the medical experimentation has raised the first ethical concerns that were at origins of medical ethics. We are not interested here in considering this important consequence, but rather in examining certain intellectual frames that accompanied and affected the transformation of medicine into a scientific discipline.

### **The experimental medicine**

The structure of Bernard's book is instructive in this respect. It begins with an accurate presentation of the experimental method in general and continues with the application of this method to the study of two different classes of "bodies", the "brute bodies" and the "living bodies", the last being the animals. In both domains an "absolute determinism" is affirmed to hold, and this is the ground for the application of the experimental method that consists in creating, through suitable manipulations of the 'natural' conditions, a certain situation from which another precise situation would causally follow with absolute necessity. The fact that such a necessary causal consequence actually occurs or not enables the scientist to accept or reject the hypothesis he is testing. The discipline in which Bernard intended to apply the experimental method is physiology, where he has brought fundamental contributions, the most famous of which is the concept of "internal environment" (*milieu intérieur*) characterized by a display of physical and chemical parameters whose values must remain stable, and whose alterations can produce pathologies. The chief procedures for testing hypothesis in the case of the living bodies are the "cadaver dissection" (basis for the pathological anatomy) and vivisection, that is,

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