

TRADITIONS OF RESEARCH ON THE DEFINITION OF CONTAGIOUS DISEASE

Establish a scientific field involves the definition of a concept or what is the same, an object of knowledge. This does not mean with science born complete once and for all, by definition. The science born incomplete, same as a partial view of reality, that is to say, all the opposite of a worldview (*weltanschauung*). Therefore, every scientific discipline has a process to be established and an epistemology that must account for its constitution. The most concepts used in science come from primitive pre-scientific notions, which must somehow overcome. This does not mean that science is cumulative or teleological. It means, rather, that their progress is born of its shortcomings.

That said the definition of an object of knowledge implies a moment of break with ideological conceptions that precede it. This means that the terms of "time", "space", "body" or "disease" acquire a restricted connotation at the time that are incorporated as concepts in a particular scientific discipline.

The concept of disease transmission or, more specifically, the concept of contagion, has a long history of theoretical approaches. But only acquires a real scientific bias in the late nineteenth century when Jakob Henle, Robert Koch and Louis Pasteur, among others, show that infectious agents are microscopic living organisms. When they are defining *the germ theory of disease*.

This milestone of medicine and microbiology involved the articulation of a numerous of "research traditions" or "styles of thought" (Laudan 1986; Fleck 1935). Many of these traditions had to be abandoned, overcome with more effective conceptual frameworks in their responses to the problems posed by infectious diseases and epidemics. Among the abandoned research traditions, we have mainly the *humoral theory*, the *theory of miasma* and *vitalism* or *spontaneous generation*. These theories may now seem tales of witches, but which has long been powerful attachment points for the research and treatment of diseases.

However, there is a historical moment in which the confluence of ways of thinking is more dramatic, and will determine the research that lead to the germ theory future. Same that for physics, the sixteenth and seventeenth centuries

represents for Medicine the birth of a new way of thinking about the human body and its pathologies.

To get an idea of the importance of the Renaissance for the medical thought is enough remember that the work of Galen is valid for a period of more than thirteen centuries. Furthermore, for physics and for medicine, also Aristotle's conception of the world had been a constant. The works of these two giants of antiquity, constituted the guidelines that had marked and defined the research, practice and understanding of the physical and human world in the better part of the formation of the modern world. Coincidence or not, the same year, 1543, they saw the light two works that would revolutionize both disciplines: *De revolutionibus Orbium Coelestium* of Nicolas Copernicus and *De humani corporis fabrica libri septem* of Andrea Vesalius.

However, the consolidation of both revolutions it will be delayed for some time. For an extended period of time, they coexist without apparent contradiction the most antagonistic traditions of research. Similar situations verify the uncertainty of the frontiers of scientific thought defending by Feyerabend. Because the apparently antithetical styles of thought –religion, animism, clinical empiricism or astrology– arrive at work together in determine the cause of infectious diseases such as syphilis (Fleck 1935).

If someone represent all this diversity of research traditions, is the Veronese physician Girolamo Fracastoro (1478-1553), considered the father of modern microbiology and epidemiology.

Fracastoro celebrity comes mainly from his poem *Syphilis sive morbus gallicus*, published in 1530. He describes the origin and characteristics of *morbus gallicus*, which had spread throughout Europe. Three centuries later the *morbus gallicus* receive the name by which he is known today in recognition of his work. However, it is in his book *De contagione et contagiosis morbis et curatione libri tres* (1546) where he investigated more widely and in depth the issue of contagious diseases. Time later he wrote a extensive commentary entitled *De sympathia et antipathia rerum liber unus*, in order to make more clear its considerations on the contagion.

Physician, poet, mathematician and astronomer, Fracastoro was the first to systematically define the disease by contagion, considering the "seeds of contagion" (that he call *seminarias*) (seedbed), as its etiological agent. For

some historians Fracastoro is the inventor of the theory of *contagium vivum* (animated contagion). But in this sense it is not very original. The idea of the "seeds" had been used extensively, throughout the history of medicine and philosophy of nature. Anaxagoras, Lucretius, Galen, Ficino and Fernel, among the most prominent, they make use of this term. The term "seed" was activated again in the literature of the Renaissance, the renewed influence of Plato.

However, Fracastoro was the first to define the different types of contagious diseases and their different specificities, with scientific interest. Although since ancient times there was a notion of contagious diseases and clinical practice of isolating patients, (according Fracastoro) nobody had "tried to say in general what is the nature of contagion, through which principle infects, how it is generated, why some are preserved in fomes and other are propagated from distance" (*De contagione*, "Dedication to Cardinal Alessandro Farnese").

Indeed, Fracastoro was the first to define the three possible modes of transmission, that is, by contact, by *fomes* (i.e. a vector that contains the seeds of the disease) and distance transmission. He further stated the specific etiology of the epidemic diseases best known as typhus, the pestilential fever, smallpox, leprosy, tuberculosis or syphilis.

The importance of Fracastoro is not having an approximate conception to the current concept of microorganism. If we have a cumulative idea of science, it is easy to fall into the error of attributing to our ancestors, concepts that do not correspond either in time or his style of thinking.

On the contrary, if desired understand to Fracastoro and your research traditions in which it is immersed, it is necessary to consider some of the problems that he intended to solve with their work. Problems that, in some respects, are of a different order to medical field (or empirical problems), but are conceptual problems (according to Laudan) that have now disappeared or they are no obvious to the modern reader.

One of the most important problems that this man of Renaissance, tried to resolve was the scholastic use of the *occult qualities*, as etiological explanations. Their answers led him to propose a theory of contagion and investigate the causes of the different epidemic diseases. In Aristotelian terms, the *occult qualities* were qualities not immediately accessible to the senses, and

hence possessing an unknown power of action. In the Middle Ages and the Renaissance, the occult qualities were commonly characterized as "insensitive" as opposed to overt qualities that could be perceived directly. However, the existence of the occult qualities could be inferred through the manifest qualities.

The problem arises when Fracastoro investigate the *distance contagion* (*De contagione*, cap. V lib. I). In the introductory dedication, he had argued that most of his contemporaries "they seems have not said anything about the contagion, except that comes from some occult property."

According to Fracastoro, this kind of transmission has the appearance of being of a different nature and being transmitted by another principle. For example, like certain type of contagious ophthalmic disease (*oftalmia*), to be forwarded through the look, according to what it was believed. In accordance with to an idea well established since the time of Galen, the vision was the result of the clash between the images emitted by objects and *animal spirits* present in the eyes. Such spirits were an active principle; that it was believed, allowed the relationship between soul and body. In your theory of humors, Galen distinguished three kinds of spirits: natural, vital and animal.

To resolve these doubts Fracastoro raises the question of the occult qualities since the conceptual frame of the Aristotelian categories. This is an interesting argument that exposes the cognitive limits imposed to who seeks to affirm or know something of reality, in the aristotelic tradition of research. Once defined the correct categories in the field of contagion disease, is unsustainable the defense of the occult properties. For if every action must be caused by a *substance* or *quality*, it is unclear what is the principle that produces the contagion. If it is believed is by the *shape*, such shape (in words of Fracastoro) "can only make local movements up, down, rarefaction and condensation, but not contagion, which in itself is not a local movement, but rather a corruption of some things and generation of some other". If one considers that is by one natural quality, it is not asserted anything unknown, "Unless they invent an unknown type of quality different to the heat, moisture or the dryness; which certainly cannot be invented". However, if it is considered as its cause spiritual qualities we have taken into account that "these spiritual things continue while material things, of which have emerged, are present, unless they have been in the intellect" (*De contagione*, 17).

In accordance with Fracastoro, the contagion transmitted at distance, in the absence of that which provokes, remains unchanged and in the air. "It is transferred from one place to another, also beyond the seas, demonstrating that it is a body; because it moves and continues to exist, despite being far from the first (in be infected)". Furthermore, according to the definition of contagion, "in the second thing has to happen the same thing happened in the first and the principle should be the same in both and the same in the third, the fourth, the fifth and the others that they receive contagion". Therefore the cause cannot be spiritual, because "spiritual things cannot generate in a second the same thing happened in the first, as all generations are produced through the first qualities". Fracastoro determined that, far from being the result of occult qualities, the etiology of infection must be explained by the action of the seeds of diseases or seminaries, which act in accordance the principle of sympathy-antipathy.

Companion of Copernicus during his formative years at the University of Padua, Fracastoro is facing to problems similar to the cosmological questions of their time: How is possible that a disease is transmitted from a long-distance? How can have influence between two bodies without there being direct contact between them? In short the question of *action at distance*.

The conception of contagion disease that Fracastoro proposed, paving the way for modern epidemiology and the microbiology, confronted the traditions of researches aristotelian and galenican with its own conceptual limitations before of the mechanistic conception. Like Descartes, Fracastoro is an exceptional example of the dialogue between the aristotelian vitalism and the nascent mechanistic vision that characterize the scientific and modern thought, in the field of medicine.

Bibliography

- Entralgo, L. (1997): *Historia de la medicina*. Editorial Masson, Barcelona.
- García Valverde, J.M. (2007): "El galenismo crítico de Girolamo Cardano: análisis de la presencia de Galeno en el *De immortalitate animorum*", *Asclepio. Revista de Historia de la Medicina y de la Ciencia*, vol. LIX, nº 1, pp. 35-64.

- Hirai, H. (2002): "La fortune du concept de semence de Marsile Ficin au XVI^e siècle". Dans *Accademia, Revue de la Société Marsile Ficin*, IV, Paris, pp. 109-132.
- Hirai, H. (2003): "Ficin, Fernel et Fracastor autour du concept de semence: aspects platoniciens de *seminaria*", in Pastore, A. e Peruzzi, E. (ed.): *Girolamo Fracastoro. Fra medicina, filosofia e scienze della natura. Atti del Convegno internazionale di studi in occasione del 450° anniversario della morte*, Verona-Padova, pp. 245-260.
- Hirai, H. (2005): *Le concept de semence dans les théories de la matière à la Renaissance: de Marsile Ficin à Pierre Gassendi*, Turnhout (De diversis artibus, 72), 73-89.
- Hirai, H. (2011): *Medical Humanism and Natural Philosophy: Renaissance Debates on Matter, Life and Soul*. Brill, Leiden – Boston.
- Hutchinson, K. (1982): "What Happened to Occult Qualities in the Scientific Revolution?". *Isis*, 73, 233-253.
- Feyerabend, P. (2013): *Filosofía natural*. Editorial Debate, Madrid.
- Fleck, L. (1935): *La génesis y el desarrollo de un hecho científico. Introducción a la teoría del estilo de pensamiento y del colectivo de pensamiento*. Madrid, Editorial Alianza, 1986.
- Fracastoro, G. (1546): *De sympathia et antipathia rerum. Liber I*. Istituto Nazionale di Studi Sul Rinascimento. Edizioni di Storia e Letteratura, Roma, 2008.
- Fracastoro, G. (1546): *De contagione, et contagiosis morbis et eorum curatione*. [Del contagio, de las enfermedades contagiosas y su curación. Trad. por Aníbal Ruiz Moreno (Uni. Nacional de Buenos Aires). Clásicos de la Medicina, Santiago de Chile, 1962.]
- Jaeger, W. (1933): "La medicina griega, considerada como paideia", en *Paideia: los ideales de la cultura griega*. Editorial Fondo de Cultura Económica, México, 1990.
- KUHN, T. S. (1996): *La revolución copernicana. La astronomía planetaria en el desarrollo del pensamiento*, Barcelona, Editorial Ariel. [Vers. ingl. (1957): *The Copernican Revolution. Planetary Astronomy in the Development of Western Thought*, Cambridge, Harvard University Press].

- Laudan, L. (1986): *El progreso y sus problemas. Hacia una teoría del crecimiento científico*. Ediciones Encuentro, Madrid.
- Nutton, V. (1983): "The seeds of disease: an explanation of contagion and infection from the greeks to the Renaissance". In *Medical History*, 27, pp. 1-34.
- Nutton, V. (1990): "The Reception of Fracastoro's Theory of Contagion. The Seed That Fell among Thorns?". In *Osiris*, Vol. 6, *Renaissance Medical Learning: Evolution of a Tradition*, University Chicago Press, pp. 196-234.
- Pérez Tamayo, R. (1996): "Los gusanos de seda, el "calcinaccio" y Agostino Bassi", en *La profesión de Burke y Hare y otras historias*. Editorial Fondo de Cultura Eómica, México.
- Sendrail, M. (1983): "El siglo de la enfermedad contagiosa", en *Historia cultural de la enfermedad*. Editorial Espasa Calpe, Madrid, pp. 307-327.
- Siraisi, N.G. (2004): "Medicine and the Renaissance World of Learning", in *Bulletin of the History of Medicine*, Vol 78, N. 1, Spring, pp. 1-36.
- Pennutto, C. (2003): "La *Natura* dei contagi in Fracastoro", in Pastore, A. e Peruzzi, E. (ed.): *Girolamo Fracastoro. Fra medicina, filosofia e scienze della natura*. Atti del Convegno internazionale di studi in occasione del 450° anniversario della morte , Verona-Padova, pp. 57-71.

Ruy J. Henríquez Garrido

Faculty of Philosophy

University Complutense of Madrid, Spain

ruyhenriquez@filos.ucm.es