

## THE CONCEPT OF PAIN IN THE 17th CENTURY

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### SUMMARY

*The 17th Century is very important in the history of sensation and pain. Philosophers, as Descartes, Hobbes, Spinoza, defined a new philosophy of science. Physicians of the iatro-chemical School introduced the first principles of biochemistry, tied to the sensations. Physicians of the iatro-mechanical School postulated a really modern concept: the importance of nerve juices in sensibility and pain.*

The 17th Century, with the new approach to science of Galileo Galilei (1564-1642), is rightly considered a standpoint in every field of science. In the history of medicine and in the evolution of the concept of pain, René Descartes (1596-1650) represents a major point of reference more for the authority of the philosopher than for the originality of the concepts, which, as regards sensation, can be found in many previous thinkers. As a matter of fact, it is not easy to follow the concepts of Descartes on sensation because they are differently expressed in various books<sup>1-5</sup>. The reference of those who studied Descartes' physiology is generally derived from *De homine*<sup>4</sup>, a minor work, published in Latin by Florentius Schuyl 12 years after Descartes' death. The first French edition (*Traité de l'homme*)<sup>5</sup> was published 2 years after the Latin one. We do not know how much this book is a work of Descartes or of Florentius Schuyl,

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who revised and put in order a part of the manuscripts left in Stockholm after Descartes' death in 1650. The same can be told for the well known figures: we do not know whether they were made by Descartes or only inspired by his work.

As a matter of fact, Descartes' philosophy is much less mechanistic than is generally thought. In the *Traité des passions de l'âme*<sup>3</sup>, the last work that Descartes published in France before going to Stockholm, he stressed the concept of *self*, which can be, at least in part, identified with the *cogitatio*, or *pensée* (consciousness), related to the well known *cogito, ergo sum* (*I think, therefore I am*).

This *self*, active in judging and willing, is passive in sensing and feeling. Its emotions and affective states of pleasure, displeasure and pain (*passions de l'âme*) defy definition and can be treated only in terms of collateral bodily disturbances which must be considered epiphenomena. As we can see, these concepts are much nearer to a neoplatonic conception of the world than to a mechanistic one.

In *De l'homme*<sup>5</sup>, instead Descartes turned to a full mechanistic interpretation of human life. He considered nerves as tubes in which there was a sort of marrow composed of fine threads, which started from the proper substance of the brain and ended in the skin or other tissues. Sensory stimuli were transmitted to the brain by means of these threads, the movement of which was conveyed to the ventricular walls, and through the ventricular fluid to the pineal gland. If central nerve threads were pulled with force enough to break them, pain was produced. The sensations became conscious in the pineal gland, where the *res cogitans* and the *res extensa* were connected. The nervous paths of sensations, from the periphery to the brain, were described by Descartes in a famous figure, representing a boy with his foot stimulated by fire (Fig. 1). It is interesting to note that this figure is concerned with the mechanisms of sensation in general, but not of pain in particular, as we can deduce from the original text.

Descartes felt the limits of his philosophical construction, especially of the union of *res cogitans* and *res extensa* in the

pineal gland. His conclusion was pessimistic: to the question *quid facti?* (*what is in fact the case?*) we must reply *ignoramus et ignorabimus* (*we are ignorant and shall remain ignorant*).

The English counterpart of Descartes was Thomas Hobbes (1588-1679)<sup>6</sup>. Hobbes was able to discuss his ideas with Galileo Galilei, whom he visited in Florence in 1636. He was so impressed by Galileo's achievements in mechanics that he sought to explain all phenomena and indeed sense itself in terms of the motions of the bodies. For Hobbes all sensation is due to movement within the sensory apparatus of the body; external stimuli impose movement to which special organs of the body react; in so doing, sensation is created. Sensation is thus an active, not a passive, event. The sensory apparatus consists essential-



Fig. 1 - The path of sensation, according to Descartes (5). The minute particles of fire (A) set in motion the spot of the skin of the foot (B) which they touch, and by this mean pulling upon the delicate thread (CC), which is attached to the spot of the skin, they open up the pore (d,e) against which the thread ends. The sensory impulses, in order to enter consciousness, pass into the cerebral ventricles (F) at *d* and across the ventricles to the pineal gland, not shown in the figure.

ly of the animal spirits contained in the nerves and in the blood vessels. According to Hobbes, animal spirits are the finest part of the vital spirits created in the heart, where the sensory center is lodged: if the movement from the sensory organ fails to reach the heart there is no sensation. The movement of a sensory stimulus reaching the heart influences its reaction and movement. If this reaction is brisk with increased activity of vital and animal spirits, pleasure results; if the heart's movement is inhibited, then pain is felt.

Benedictus De Spinoza (1632-1677)<sup>7</sup>, who knew Plato, Aristotle and the Jewish thinkers of the Middle Ages very well, admired Descartes and reformulated *cogito ergo sum* (*I think, therefore I am*) in *ego sum cogitans* (*I, being conscious, am existent*). He was deeply influenced by Descartes' philosophy but at the same time in his major work, the *Ethica ordine geometrico demonstrata*, he rejected the dualistic conception of Descartes *res cogitans-res extensa*. In the second book of the *Ethica* the mind is called *idea of the body*: mind and body are alternative expressions. The concept of *conatus* (excitement) is fundamental. From the *conatus* the primary emotions derive: *cupiditas* (desire), *laetitia* (joy), *tristitia* (pain). According to Spinoza, physical pain was felt when one of the parts of the human body was affected more than the others; melancholy, on the other hand, when all parts were equally affected. Spinoza made trenchant criticism of Descartes' anatomy and physiology, as written in the *Passions de l'âme*. In the *Ethica* (fifth book, preface) he wrote: *I can hardly wonder enough that a philosopher who firmly resolved to make no deduction except from self-evident principles, and who blamed the schoolmen because they desired to explain obscure matters by occult qualities, should accept a hypothesis more occult than any occult quality.*

With Thomas Willis (1622-1675)<sup>8</sup> we return to the discovery of structures in the nervous system concerned with sensation and pain. Willis noted that the meninges are sensitive and considered them therefore as the origin of headaches. He tried to correlate sensations and especially pain with different struc-

tures in the brain. The *affect*, the pain of sensory stimulation, is located by Willis in the *corpus striatum* and *corpus callosum*. The reflex effects of such pain pass down to the *corpora quadrigemina*, thence by the superior cerebellar peduncles to the *cerebellum*, from which emerge all the visceral and other involuntary movements expressive of pain. Motor nerves emerging through the anular protuberance (the pons) supply the expressive muscles of the face and eyes and the thoracic and abdominal viscera. They thus constitute special nerves for the expression of pain and pleasure.

During this period, the correlations between sensations and anatomical findings began to be observed. Théophile Bonet (1628-1689), in his *Sepulchretum*<sup>9</sup> wrote that *dolor pectoris* (chest pain) could be a serious symptom and described the case of a patient with chest pain who died suddenly: in this case, at the autopsy, the coronary arteries were found occluded. It is clearly a description of a myocardial infarction two centuries before Herrick's studies.

The most original thought on the concept of pain is expressed in the 17th Century by two important Schools: the iatrochemical and the iatro-mechanical.

Jan Baptista Van Helmont (1577-1644)<sup>10</sup>, of the iatro-mechanical School, introduced the concept of *ferments*. He considered that digestion, nutrition and movement are due to ferments which convert dead food into living flesh in six stages.

These stages are related to six *archaei insiti*, chemical loci, arranged in a given hierarchy, which preside over and direct the affairs of the body (Fig. 2).

The *archaeus 1* is in the body of the stomach, the *anima sensitiva* (*sensitive soul*) is in the pylorus. According to Van Helmont, an *alien ferment* perverts the action of the *digestions*: such perversion underlies pain. The rheumatic pain is produced by the disturbance of local *archaei* and their ferments and by the introduction of *alien ferments*. Sensations are therefore chemically specific.

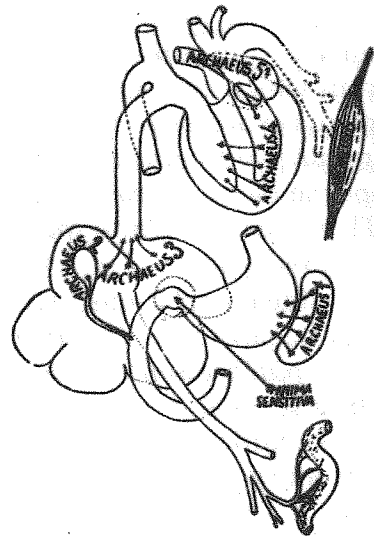


Fig. 2 - Van Helmont's location of the sensitive soul at the pylorus. The six digestions and six *archaei* were theorized by Van Helmont<sup>10</sup> and the early iatro-chemists.

With Giovanni Alfonso Borelli (1608-1879)<sup>11</sup>, of the iatro-mechanical School, we arrive to a really modern concept: the importance of nerve juices. The *succus nervus nutritivus* has what we call today a trophic function; the *succus nervus spirituosus* controls motor and sensory functions. Irregular agitation of this juice is conveyed to the brain, where it produces the disagreeable sensation of pain.

Lorenzo Bellini (1643-1703), Borelli's disciple, devoted much work to developing a theory of *stimuli* which spread its influence over most of Europe. A stimulus, according to Bellini<sup>12</sup>, consists essentially of the movement of a part of the body, the sensation from which, always more or less painful, arises in a nerve. The change in the nerve consists of the separation of the parts

of its substances, either by deforming, compressing or rupturing it; in any case pain is a constant element of the sensation produced.

Giovanni Baglivi (1669-1707)<sup>13</sup> was very impressed by the observations on the sensitiveness of the meninges and by their pulsation. The brain itself, he emphasized, is insensitive, whereas with meningeal disease or injury there are pain and convulsions. According to Baglivi, pain is mainly produced by irregular vibrations passing up nerves to the *pia mater*, from the membranes of the *viscera* as well from external tissues.

The positive contribution of the Italian iatro-mechanical School (Borelli, Bellini, Baglivi) lies in the insistence on the transmission of nerve impulses as a physical event, not a *spiritual* one, and in the constant interpretation of sensory phenomena in terms of vibrations along nerve fibres.

Marcello Malpighi (1628-1649)<sup>14</sup>, a friend of Borelli, believed that, when the nerve juice reaches a part, it makes it sensitive. If the flow of nerve juice is interrupted, the part becomes excessively sensitive and painful.

It is noticeable that, with Borelli and his School and with Malpighi, the *animal spirits* through the 17th Century gradually lost their *spiritual* part and became a kind of chemical fluid.

Isaac Newton made some tentative suggestions about the working of nervous system. In the *General Scholium*, added to the second edition of the *Principia*<sup>15</sup>, he included the idea of an all-pervading elastic aether *exceedingly more rare and subtle than the air*, which he again suggested in the series of *Queries* added to the second English edition of his *Opticks*<sup>16</sup>: *I suppose that the capillamenta of the nerves are each of them solid and uniform, that the vibrating motion of the aetherial medium may be propagated along them from one end to the other uniformly, and without interruption.*

In conclusion, we think, according with eminent scholars<sup>17-18</sup>, that the period between Descartes and Newton, shortly summarized in this paper, is very important in the history of the concept of sensation and of pain in particular.

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Articoli/Articles

UN MEDICO ALLA MODA NELLA PARIGI DEL SETTECENTO  
OVVERO MESMER, IL MESMERISMO  
E LA MESMEROMANIA

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SUMMARY

MESMER AND MESMERISM

*The arrival of a Viennese doctor in Paris during the second half of the XVIII century aroused a morbid excitement: Mesmeromania, which derived from the name of its protagonist Mesmer. Initially, with the aim of healing mental illnesses, Mesmer tried to use the magnet's power in order to restore the harmonious circulation of the fluid which he believed to run through our nervous system. Holding that he had found, by chance, the same properties in the human body as in the magnet, Mesmer began to execute direct magnetization experiments, and thus gave rise to interest from sick and curious people belonging to every social class. The fashion for mesmerism, and consequently an unbridled mesmeromania, rapidly pervaded Parisian society.*

Franz Anton Mesmer (1734-1815) svolge i suoi studi a Vienna dove consegue la laurea in medicina con una dissertazione singolare, colorata di misticismo, intitolata *Dissertatio physico-medica de planetarum influxu*<sup>1</sup>. Qui egli, rifacendosi alle teorie newtoniane, ammette l'esistenza di una influenza esercitata dagli astri sull'individuo, simile all'influenza dell'attrazione

Parole chiave/Key Words: Animal magnetism - Mesmer - Mesmerism - Magnetic fluid