

René Descartes

Introductory article

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(1596–1650) French natural philosopher whose mechanization of physiology was coupled with a speculative psychosomatic medicine.

Descartes was born in La Haye (now Descartes) in Touraine and educated at the Jesuit college of La Flechè in Anjou. Descartes' modern reputation as a rationalistic armchair philosopher, whose mind–body dualism is the source of damaging divisions between psychology and the life sciences, is almost entirely undeserved. Some 90% of his surviving correspondence is on mathematics and scientific matters, from acoustics and hydrostatics to chemistry and the practical problems of constructing scientific instruments. Descartes was just as interested in the motions of matter as in the supernatural soul, and he advised against spending too much time on metaphysical inquiries which neglect imagination and the senses.

After meeting the Dutch engineer Isaac Beeckman in 1618, Descartes became committed to a systematically 'mechanical' account of nature. This involved explaining all natural processes in terms of interactions between microscopic material bodies in motion. Descartes modelled his physics and cosmology on the behaviour of fluids, which also have a distinctive and central role in his physiology: the key processes for natural philosophical investigation are the circulation and mutual displacement of constrained bodies, rather than the isolated collisions of atoms in a void.

Descartes settled in Holland in 1628, and commenced an ambitious programme of physiological research. In 1630 he was 'studying chemistry and anatomy simultaneously', and in late 1632 he was 'dissecting the heads of various animals', in order to 'explain what imagination, memory, etc. consist in'. By late 1633 Descartes had almost completed *L'homme*, the *Treatise on Man*; but he abandoned plans to publish it along with a work on matter theory and optics which relied on Copernican cosmology, after he heard of the condemnation of Galileo. *L'homme* was published posthumously in 1662 (Latin) and 1664 (French); not until 1972 was it fully translated into English.

L'homme draws on many (mostly unnamed) Renaissance medical writers, and covers, firstly, a range of traditional physiological topics, such as digestion and respiration. Descartes accepted the circulation of the blood, but thought it more consistently mechanistic to see the heart as a furnace than, with Harvey, as a pump. Descartes sought to eliminate teleology from life science by showing that biological matter has no specific intrinsic powers or built-in ends, and that its capacities derive from various complex organizations of ordinary physical particles. So he rejected the 'vegetative' and 'sensitive'

souls of Galenic and Aristotelian medicine, along with the correlated 'natural' and 'vital' spirits. Even if Descartes saw the soul as nonphysical, there is no corresponding dualism between matter and life in his work: physiological functions differ only in complexity from other mechanical operations. This is underlined by Descartes' conceit that *L'homme* describes only a fictional world of soul-less 'earthen machines', self-moving automata analogous to artificial hydraulic engines in 'the gardens of our kings'. Even the 'animal spirits' or nervous fluids which play key roles in his physiological psychology 'are merely bodies', derived from the finest parts of the blood, which 'never stop in any place'.

But the bulk of *L'homme* is devoted to muscular motion, reflex action, and sensation, all explained by reference to the structure of the nerves, the nature of the flow of animal spirits through nerves and brain pores, and the current state of the brain. While Descartes departs from the tradition that located cognitive processing primarily in the cerebral ventricles, he is uninterested in localizing functions in specific brain structures, being content to take the brain as a relatively undifferentiated 'dense and compact net or mesh' (Figure 1). He assigns the pineal gland a unique role, not just as the link to the soul, but also in the executive control of brain processing: as a unitary and central structure, the gland sways or dances on its supporting

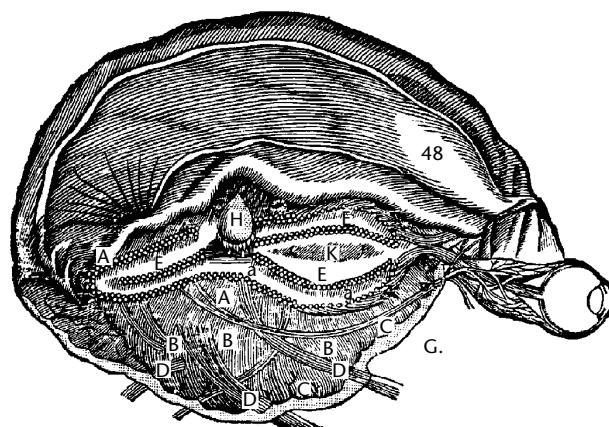


Figure 1 'The whole brain is nothing but a tissue constituted in a particular way'. Illustration of the brain as a 'net or mesh', with the pineal gland (H) in the centre, from the first French edition of Descartes' *L'homme*.



Figure 2 Descartes' conception of reflex action. The stimulus A pulls the nerve fibre at B and thus opens the entrance to a particular pore in the brain, allowing the influx of the animal spirits into the nerves and leading to immediate muscular motion. The oval 'cavity' in the brain labelled F is not the pineal gland but the ventricle. From *L'homme*.

network of arteries, and can thus direct the patterned flow of animal spirits through the tubes and traces of the brain.

Perceptual representation occurs not by copying little images into the brain for the soul to see, but through the neural transmission of patterns structurally isomorphic with the sensory input. In hearing, for example, blows on the tympanic membrane pass to the brain by the nerves, and the soul's conception of different sounds depends on the current state of the brain and on various relations between the blows, such as their frequency: quantitative differences between patterns of blows result in qualitatively different sensations.

Physical 'ideas' are the patterns traced in spirits on the surface of the pineal gland. As Descartes observed in

dissection, nonhuman animals also have pineal glands. Thus, despite ongoing vilification by animal rights activists (including an old story that he vivisected a dog on his kitchen table), Descartes allows representation and indeed sentience even in 'beast-machines'. In true reflexes (Descartes discusses swallowing, blinking, coughing, sneezing, and yawning), the pineal gland is not involved and there is no plasticity (**Figure 2**). But the pineal gland is involved in many more complex cognitive operations which nevertheless do not require the soul. The case of associative memory makes this clear. Perceptual ideas or patterns transmitted by spirits through the gland bend or rearrange the enduring structure of brain fibres, and 'trace figures in the gaps, which correspond to those of the

objects'. Remembering is then the reconstructing of patterns of motions in the spirits, and relies on modifications made over time to the 'folds of the brain' (Figure 3). Descartes also allows for body memory, for example in a lute player's hands. He goes on to offer related psychophysiological accounts of learning, imagination and dreams.

So Descartes does not conceive of the body as an object cut off from the environment and responding passively to current stimuli or to the whim of the soul. Instead, in addition to many internal systems of nonlinear feedback in the maintenance of bodily homeostasis, he allows for direct and continuous lines of influence between body and world. The state of the key body fluids such as animal spirits and blood depends not only on the qualities of food and on the digestive system, but also on the states of liver, gallbladder, spleen and heart, on respiration and climate, and on the production of passions and anxiety. All the causal influences on physiological processes act holistically, and even an automaton's behaviour is not wholly preprogrammed, for its physiology changes over time, so that automata with different histories will respond differently. More generally, Cartesian physiology is not a powerful technological disenchantment of nature. Indeed in the case of many traditional wonders, such as the imprinting of traces from a pregnant woman's imagination on a fetus, and the 'weapon salve' which was to be applied to the sword rather than the wound, Descartes accepts the marvellous phenomena, but seeks mechanical explanations.

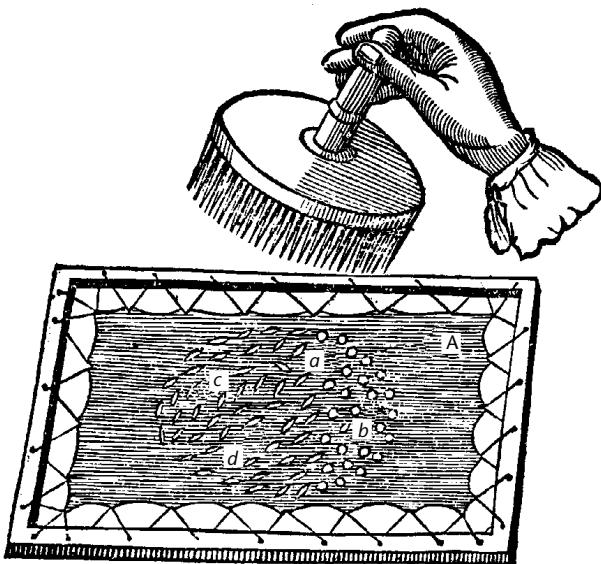


Figure 3 Descartes' analogy for associative memory. Just as the repeated passage of needles through a linen cloth leaves traces, so certain 'passageways' in the brain are altered in perceptual experience, and thus 'become more apt than the others to be opened in the same way when the [animal] spirits again flow towards them'. From *L'homme*.

Most modern philosophers know Descartes through his writings on metaphysics and epistemology, the *Discourse on the Method* (1637) and the *Meditations* (1641), in which he defends the immateriality of the soul and seeks secure methodological foundations. It is ironic, then, that Cartesianism was criticized less in the seventeenth and eighteenth centuries for its radical dualism than for the opposing possibility, that a materialist view of the mind could be extracted from Descartes' physiological works, as indeed it was by la Mettrie. Orthodox critics sought to tarnish Descartes' reputation, with stories such as those about Descartes' illegitimate daughter Francine which circulated in the eighteenth century: having allegedly conceived the girl with a housemaid simply in order to study reproductive physiology at close quarters, after her tragic death of scarlet fever (which the historical Descartes called 'the greatest sorrow of my life') he was said to have built and travelled with a lifesize automatic replica.

Descartes continued to work on a variety of physiological topics throughout the 1640s. His sophisticated but bizarre embryology is contained in his *Description of the Human Body* (in Descartes, 1998), while his views on the mechanisms of psychosomatic interaction were further developed in response to persistent queries from Princess Elizabeth of Bohemia. In *The Passions of the Soul* (1649), Descartes moves from explanations of the psychophysiology of conditioned responses to suggestions on the wise enjoyment of specific emotions. By coming to know our own histories and bodies, and by gradually training and altering the ingrained habits of body and brain, we can prepare ourselves 'against all the contingencies of life'. This attempt to link medicine and morality by understanding the individualized dynamics of the union of mind and body, like much of Descartes' physiological work, will perhaps prove of more interest in the twenty-first century than our myths about Cartesian metaphysics.

Further Reading

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