

Nicolaas Hartsoeker

Nicolaas Hartsoeker, a Dutch astronomer, optics manufacturer, and naturalist, was born 26 March 1656 in Gouda, Netherlands, and died 10 December 1725. His mother was Anna van der Mey and his father was Christiaan Hartsoeker, a prominent evangelical minister. His major contribution to embryology was his observations of human sperm cells, which he claimed to be the first to see under a microscope. His sketch of the homunculus, a tiny preformed human he believed to exist in the head of spermatazoa, is his lasting scientific legacy in the field of embryology. This sketch was only a minor part of his first publication, *Essai de Dioptrique* (1694), which dealt primarily with the use of optical lenses in science. In subsequent years the sketch became iconic of the theory of embryological development known now as preformationism. Hartsoeker himself was a vocal adherent of spermist preformationism and is often cited as the originator of the idea.

Hartsoeker's father wanted his son to follow in his theological footsteps, but Nicolaas was interested in astronomy and physics. According to most accounts of his life, the younger Hartsoeker secretly studied mathematics, physics, and astronomy, paying for lessons from a local tutor out of the small allowance granted him by his father. Hartsoeker also taught himself the skill of forming and grinding glass for optical lenses. He claimed to invent a technique for making superior magnifying lens for microscopy, a technique also attributed to Johann Hudde, which consisted of forming glass filaments into spherical globules by exposing them to open flame. In 1672 the sixteen-year-old Hartsoeker approached Anton Leeuwenhoek, the Dutch microscopist who was by then an old man, to learn about microscopes, but the two did not get along well. Hartsoeker, who had the reputation of being highly confrontational and disputatious, criticized Leeuwenhoek's work in embryology and microscopy to the point of ridicule in his final and posthumously published work *Cours de Physique* (1730). Hartsoeker reportedly studied at the University of Leiden in 1674, focusing on both anatomy and philosophy. However, a note to Hartsoeker's mentor Christian Huygens from his brother Constantijn Huygens claims that Hartsoeker had no higher education; it is believed he was largely self-educated and there is no evidence that he ever obtained a degree.

Hartsoeker's work in embryology was a result of his interest in creating magnifying lenses for microscopes. He claimed to have observed sperm cells in 1674, but first assumed that the wriggling little cells were a type of parasitic animalcule, the term at the time for what we now call protozoa. He did not look at semen again for three years, and when he once more observed the strange little cells, he asked Huygens and his mathematics tutor to look at his samples as well. From these observations, he drew the famous picture of the tiny human curled up within the head of the sperm cell. However, in the text surrounding the sketch in *Dioptrique*, Hartsoeker made it clear that he did not actually observe the "petit l'enfant," and was suggesting instead that this is what could be seen, were there a way to peer inside the sperm.

Hartsoeker became an outspoken proponent of the spermist version of preformation theory, in which each new life-form exists fully formed though extremely tiny in the spermatazoa of its father. His reasons for adopting spermism over the competing preformationist ovist view, other than a certain degree of bias due to his discovery of sperm in the first place, revolve mainly around the lack of proof that eggs exist in the female prior to fertilization. Further, for Hartsoeker and other spermists, the mere existence of the wriggling animals in semen indicated that they must have an important purpose in the conception of offspring. Having already accepted preformationism, it was self-evident to Hartsoeker that the homunculus must exist within the sperm.

Hartsoeker's views evolved and changed to answer the objections raised by other philosophers and biologists of the time that spermism necessarily implied a very wasteful God who had created

millions of animals and humans that would never be born. Hartsoeker was one of the originators of an idea then called panspermism, which addressed the problem of wastefulness by suggesting that the unused sperm turn into small particles that float through the air until they are recycled back into sperm. He rejected that idea later on and turned instead to a concept in which an intelligent force within each male animal creates the homunculus within the sperm. However, Hartsoeker was ultimately never able to fully reconcile the philosophical problems presented by preformationism. Like many other spermist preformationists, he eventually fell back on the explanation first used by Leeuwenhoek, that wastefulness is often observed in Nature, and should not seem out of place in humans.

Hartsoeker's specialty was optics, not embryology. Thus, a great deal of his work was in the creation of lens for telescopes and in astronomical observations using his inventions. Indeed, *Essai de Dioptrique* did not discuss the observations of sperm and the implications for preformationism until the tenth chapter. The first chapters were focused on Hartsoeker's astronomical use of lenses and his future work, such as his intention to create a map of the Moon. He accompanied Huygens to Paris in 1678 and worked there with members of the French astronomical community, including Giovanni Cassini. He returned to the Netherlands in 1679, married, and returned to France in 1684, where he and his wife ran a successful trade crafting and selling lenses, microscopes, and telescopes. He continued to make his own scientific observations, and again moved back to Holland in 1696.

In 1697 Czar Peter the Great and his Grand Embassy of Russia came to Amsterdam. Hartsoeker was introduced to the monarch and instructed him in physics. Peter invited him to St. Petersburg to teach physics and mathematics at the university there and to continue the royal family's own education. Hartsoeker chose not to accept the invitation, remaining in Amsterdam to work in the observatory built for the Czar by the city. He later taught physics for a time to the Count of Hesse-Kassel. The Count then secured him an appointment to teach math and philosophy at the University of Dusseldorf, where he remained until 1716 when he retired to Utrecht. He died there in 1725.

Nicolaas Hartsoeker, as one of the originators of spermist preformationism, had a lasting impact on the field of embryology despite it not being his main area of academic pursuit. His ideas are still taught as part of the history of embryology and natural science, and his sketch of the homunculus remains a highly recognizable symbol for this period of scientific work.

Sources

1. Pinto-Correia, Clara. *The Ovary of Eve*. Chicago: University of Chicago Press, 1997.
2. Van Cittert-Eymers, J. G. "Hartsoeker (or Hartsoecker), Nicolaas." *Dictionary of Scientific Biography* 6: 148-9.