Jan Swammerdam (1637-1680) [1]

By: Buettner, Kimberly A. Keywords: Biography [2] Preformationism [3]

Jan Swammerdam [4], known as the founder of the preformation [5] theory based on his extensive research on insect development, was born on 12 February 1637 in Amsterdam, the Netherlands, to Baertje Jans Corvers and Jan Jacobszoon Swammerdam. He began medical school on 11 October 1661 at the University of Leiden [6]. A few of his classmates included Regnier de Graaf [7], Frederik Ruysch [8], Niels Stensen [9] (Nicolaus Steno), and Robertus Padtbrugge. Padtbrugge would later join the East India Company and send Swammerdam exotic animals.

While attending medical school Swammerdam was active in research. Two of his professors at the University of Leiden [6], Franciscus dele Boe Sylvius and Johannes van Horne [10], referred to Swammerdam's student research in their publications. Swammerdam qualified as a medical candidate in October 1663 and left for Saumur, France, to stay with Tanaquil Faber, a professor of philology at the Protestant university there.

In September 1664 Swammerdam, along with Steno, moved to Paris as a guest of Melchisédech Thévenot. He was an active member of Thévenot's scientific academy, a club that met to watch experiments and dispute Cartesian ideas. In September 1665 Swammerdam returned to Amsterdam and joined the Private College of Amsterdam, a group of physicians which included Gerhard Blaes (Blasius) and Matthew Slade. In 1672 the group published a description of their dissections. In the same year, Swammerdam's dissection of a silkworm [11] revealed the structures of an adult moth and further contributed to his preformation [5] theory.

In the winter of 1666–1667 Swammerdam once again resided in Leiden. There he dissected insects [12] and researched the anatomy of the uterus [13] with van Horne. Swammerdam and van Horne collected both male and female reproductive organs [14], and Swammerdam used wax injection [15] to distinguish the vessels, since the injection allows soft body parts to retain their structure. From this research, van Horne, Swammerdam, Steno, and de Graaf concluded that organs formerly known as female testes [16] were actually ovaries like those of egg [17]-laying animals, and Swammerdam claimed to have seen eggs inside these structures. Although Karl Ernst von Baer [18] is usually credited with the observation of ovaries in mammals, we see that the concept was known during the seventeenth century as well. On 22 February 1667 Swammerdam received his MD degree after completing a thesis based on his respiration research in 1663. In 1670 he was given the privilege of dissecting human bodies in Amsterdam, which at the time required a special license available to only limited numbers of researchers.

In 1669 Swammerdam set out to disprove the idea of metamorphosis [19] in his work *Historia Insectorum Generalis*. Swammerdam proposed that all insect development falls into four categories. The first group includes insects [12] that hatch from eggs in their adult form, undergoing no further change except growth. The remaining three groups include animals that hatch from eggs before having reached the adult stage. However, in all of the categories, Swammerdam argued that all organisms come from the egg [17] of a female of the same species. While Swammerdam used insects [12] for a large portion of this research, he demonstrated similar development patterns in frogs to show the parallel in higher organisms.

In 1671 Francesco Redi's research on spontaneous generation [20] stimulated Swammerdam to gather information on insects [12] that cause plant galls. Swammerdam's refined micro-dissection skills, using sharp scissors and injecting fluids such as wax, mercury, air, and alcohol, led to the demise of the idea that insects [12] consisted of humors. In addition to creating his own simple microscopes, Swammerdam used Jan Hudde's single-lens microscope [21] and Samuel Musschenbroek's microscope [21] with flexible arms to find that a frog [22] embryo consists of globules and that there are particles in the blood. He rejected theories about spontaneous generation [20] and metamorphosis [19] on religious grounds. He regarded these beliefs as atheistic since the idea allowed chance and accident to rule rather than law and regularity. He believed that living things developed in eggs and that growth was merely an increase in the parts already present rather than the development of new parts by chance. Using frogs to demonstrate his point, he identified the black spot of a frog [22] egg [17] as a frog [22] itself with all necessary parts intact, needing simply to grow rather than to develop.

Swammerdam died in Amsterdam on 17 February 1680. In his will he gave permission to Hermann Boerhaave [23] to publish his manuscripts, which Boerhaave published as *Biblia Naturae* [24] in 1737–1738.

Sources

1. Cobb, Matthew. *The Egg and Sperm Race*. London: Free Press, 2006.
2. Winsor, Mary P. “Swammerdam, Jan.” *Dictionary of Scientific Biography* 13: 168–75.

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