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Kaspar Friedrich Wolff (1733-1794)

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Kaspar Friedrich Wolff is the eponym of four anatomical structures related to the genitourinary system. The Wolffian tubules (*aka* Kobelt's tubules, named after the nineteenth-century German physician Georg Ludwig Kobelt) are the remnants of the Wolffian duct in the paroophoron, i.e., the broad ligament between the epoophoron and the uterus. The Wolffian body is a name alternatively used for the mesonephros, the transient excretory organ of mammals which is replaced in the adults by the metanephros or kidneys. The Wolffian cysts are the cysts located in the broad ligaments of the uterus, arising from any mesonephric structures. And the most important anatomical term is the Wolffian duct, the embryonic duct draining urine from the mesonephros to the cloaca, the primitive bladder outside the body. The Wolffian duct gives rise to the deferent duct in adult males, and their remnants make up the rudimentary Gartner's duct in females.

Kaspar F. Wolff was a German surgeon, anatomist and embryologist, born in Berlin (18-1-1733) and dead in St. Petersburg (22-2-1794) (Nordenskiold, 1928; Eisner and Bloom, 2002). He was one of the founders of descriptive embryology. A tailor's son, he started medical studies in Berlin (Medical-Surgery College), and he continued in the University of Halle, where he studied rationalist philosophy with the mathematician and philosopher Christian Wolff, a pupil of Leibniz. In this university he got his degree as a Doctor of Medicine in 1759, with a famous dissertation which was published in that same year with the title *Theoria generationis*. This work was very shocking, since it appeared in the midst of the debate between the epigeneticists and the preformationists, two radically different and competing theories about the reproduction and the development of the living beings. *Theoria generationis* is considered to be the main contribution to embryology in the period between Marcello Malpighi (1629-1694) and Karl Ernst Von Baer (1792-1876). Its publication started a long-lasting epistolary debate between Wolff and another important eighteenth-century embryologist and physiologist, the Swiss Albrecht Von Haller (1708-1777) (Belloni, 1971). Von Haller claimed that the lack of empirical evidence about preformed parts of the embryo could not be alleged as a proof of their inexistence. He had published in 1758 his book *Sur la formation du coeur dans le poulet*, defending preformationism.

Eighteenth-century preformationists such as Charles Bonnet or Lorenzo Spallanzani claimed that the beings were already formed in the gametes, either in the ovum or in the sperm. The discovery of parthenogenesis by Bonnet or the wrong descriptions of the spermatozoids as "homuncules" contributed greatly to support this point of view. From the strictly religious perspective, preformation also solved the conflict of the continuous creation of new beings, since the divine Creation had been finished in the sixth day, according to the Genesis. Epigeneticists, however, described development as the result of the progressive organization, due to forces of unknown nature, of a homogeneous material (called "*ovo*" by William Harvey, who consequently stated "*omne vivum ex ovo*"). Preformationists accused epigeneticists of embracing "old-fashioned" views (Aristotle was the first epigeneticist, rescued in the seventeenth century by William Harvey), and of being unable to explain the nature of the "forces" organizing the embryo. In the context of a conception of Nature dominated by the mechanistic views by Descartes and Leibniz, the notion of non-mechanical "forces" was regarded with distrust.

In this historical context, Wolff revived Harvey's

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ideas about epigenesis, supplying a large number of microscopical descriptions of plant and animal development. William Harvey could not, obviously, support his epigenetical theory with microscopical observations. Wolff described plant development, showing the differentiation of the leaves from the blossoms, and also described the development of some animal embryos, particularly of chicken. Wolff suggested the existence of a "*vis essentialis corporis*" or essential formative force organizing the primordial fluids. Wolff acknowledged that the idea of an inner force as the ultimate cause of the organic life was borrowed from the work of Georg Ernst Stahl (1659-1734), a former Professor of Medicine in Halle, doctor of the king of Prussia Friedrich Wilhelm I, and creator of the concept of the phlogiston to explain the combustion. Stahl believed in a vital force enlivening the living beings, and his ideas were very influential throughout the eighteenth century.

Wolff attempted to find a parallelism in animal and plant development, based on the absorption of nutrients and growth. Plant development, according to Wolff, occurred by absorption of moisture in the roots. Evaporation of the moisture in the leaves gives them more density and consistence, forming *ampullae* (the cells) and ducts. In a similar fashion, the chick embryo would obtain nutrients from yolk, which would coagulate giving rise to embryo tissues and organs. Some historians of Biology have criticized the Wolff's preference for the reasoning and the speculation than for the careful observation. For example, he considered vascular tissues of plants and animals to be the same kind of structure. However, his comparison between animal and plant organic structures was really visionary, since it anticipated the cellular theory by Schwann and Schleiden in almost 80 years. In the nineteenth century, cellular theory identified cells as the common structures of all living beings, allowing for the methodologically reductionist study of life. Paradoxically, Wolff's studies, more based on theoretical ideas about his conception of life than on empiric evidence, can also be regarded as precursors of natural philosophy, an anti-analytical and anti-reductionist tendency in Biology which was very important, especially in Germany at the end of the eighteenth and beginning of the nineteenth centuries, closely related to Romanticism. However, Wolff's essentially theoretical arguments against preformation, and this philosophical approach was misunderstood by his contemporaries. Thus, Wolff's work was only well appreciated after his death, when epigeneticists had already won the debate, mostly due to the lack of preformationist explanations for the crossed inheritance of traits, the regeneration of the organs or the malformations.

Fig. 1. Reproduction of the Eighteenth Century illustration in C.F. Wolff, *Objecta meditationum pro theoria monstrorum*. Sumptibus Acad. Sci. URSS, Typis Nauka, Leninopoli, (1973). Author: F. Anting, an eighteenth-century artist. Illustration digitalised by Alexei Kouprianov. Source: Wikimedia Commons, the free media repository.

After his M.D. dissertation, Wolff was enrolled in 1761 as surgeon of the Prussian army in the Seven Years War, being assigned to a field hospital near Breslau (now Wroclaw, Poland), where he continued his anatomical research and gave lectures to medical students. When the war ended in 1763, Wolff returned to Berlin, and he found many difficulties to teach in the University, due to his provoking ideas on anatomy and embryology, which were rejected by the academia. The anti-mechanistic approach of Wolff, and his rejection of the Cartesian concept of the organism as a machine, confronted him with the prevailing ideas about the medical practice of his time. Finally, thanks to the Swiss mathematician Leonhard Euler, Wolff obtained an offer from Catherine the Great of Russia for a Chair of Anatomy and Physiology at the St. Petersburg Academy of Sciences. He started his work there in 1767, and during the next 27 years he published many articles in the Academy's Proceedings, describing the development of the intestine, the heart or the connective tissue. *De formatione intestinorum* (1768) is his most relevant work at this time. Wolff died from a brain haemorrhage in 1794, when he was interested in human monstrosities, and was prob-

ably preparing a theory to explain them in terms of developmental anomalies.

Theoria generationis was translated from Latin into German by another of the founders of embryology, Johann Friedrich Meckel (1781 – 1833). The original Latin edition can be downloaded freely (http://books.google.es/books?id=4ZlS5D9A_8QC), and most of the German edition is accessible online (http://books.google.es/books?id=2u_xFCVNTQEC).

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