Johann Friedrich Meckel, the Younger (1781-1833) [1]

By: O'Connell, Lindsey Keywords: Meckel's diverticulum [2] recapitulation [3] recapitulation theory [4] Meckel-Serres law [5]

Johann Friedrich Meckel [6] studied abnormal animal and human anatomy in nineteenth century Germany in an attempt to explain embryological development. During Meckel's lifetime he catalogued embryonic malformations in multiple treatises. Meckel's focus on malformations led him to develop concepts like primary and secondary malformations, atavism, and recapitulation–all of which influenced the fields of medicine and embryology [7] during the nineteenth and twentieth centuries.

Meckel was born 13 October 1781, in the university town of Halle, Germany. His father, Phillip Friedrich Theodor Meckel, and his grandfather, Johann Friedrich Meckel [6] the elder, were physicians and anatomists and Meckel grew up helping his father prepare new specimens for the anatomical museum in their house. Meckel attended a local elementary school until the age of fourteen, when he traveled to Magdeburg, Germany to study at the Cathedral Gymnasium, a university preparatory school.

From 1798 to 1801 Meckel attended the University of Halle [8], in Halle, Germany, where he studied medicine and anatomy. During those years at Halle, Meckel's professors included Kurt Sprengel, Johann C. Reil, and his father. Reil was Meckel's mentor and encouraged him to study brain anatomy. In the final year of his doctoral degree studies, Meckel transferred to the University of Göttingen, in Göttingen, Germany, where he worked on comparative anatomy with Johann Friedrich Blumenbach. After a year at Göttingen, Meckel returned to Halle and presented his thesis on cardiac abnormalities, "De Cordis Conditionibus Abnormibus" (Abnormal Conditions of the Heart), after which he received his doctorate in 1802. Portions of his dissertation were published three years later, in which Meckel introduced for his concepts of primary and secondary malformations–the former refers to a developmental anomaly, while the later refers to a condition that arises as a result of another malformation.

After graduating from Halle, Meckel traveled to Würzburg, Germany, and Vienna, Austria, to see the anatomical collections housed in each city. Meckel returned to Halle in 1803 to attend his father's funeral and finish publications left unfinished by his father's sudden death. In 1804 Meckel left Halle again, this time to visit Paris, France where he met and worked with Étienne Geoffroy Saint-Hilaire, Alexander von Humboldt, and Georges Cuvier [9]. With Cuvier, Meckel helped to analyze the specimens found in the collection at *Jardin des Plantes* (Botanical Garden), all of which Cuvier described in his five volume *Leçons d'anatomie compare* (*Lessons in Comparative Anatomy*), published from 1799–1805. While in Paris, Meckel also traversed the countryside looking for bird eggs to use in his study of embryology [7].

In 1806, Meckel returned to Halle to find Napoleon's forces occupying his hometown. Napoleon had closed the university and set up his temporary headquarters in Meckel's home. In May of 1808 the university reopened and Meckel received the position of professor of surgery, normal and pathological anatomy, and obstetrics. One year later, he married Friederike von Kleist, a woman who aslo studied anatomy and who began to administer his anatomical collection.

In 1809 Meckel published about a birth defect where the connection between the fetus's intestine and the mother's yolk [10] sac does not close, resulting in internal bleeding of the newborn. Meckel gave an early description of the phenomena, later called Meckel's diverticulum, and he linked it to a problem that occurred during embryonic development.

Throughout the rest of his life Meckel continued to teach, conduct research on pathology, and obtain specimens for his collection. He wrote on various anatomical and embryological topics. In 1810 Meckel finished the German translation of Cuvier's *Leçons d'anatomie comparée* (Lessons in Comparative Anatomy) with the addition of his own findings. In the translation, Meckel drew a parallel between the order of animals, the stages of development, and the *scala naturae* (scale of nature), sometimes called the great chain of being. *Scala naturae* is the theory that nature contains a hierarchical scale not based on common descent, in which humans [11] reside at the top of earthly creatures but beneath angels and God. Meckel also accepted the idea of recapitulation, wherein embryos of higher animals on the *scala naturae* developed successively through the forms of the lower animals on the chain. For Meckel's theory of recapitulation, human embryos passed through stages in which they resembled lower forms of life. Meckel used this idea in his study of human malformations, which he interpreted as akin to the arrest of development at stages where the fetus [12] resembled lower, more primitive animal forms. Meckel traced human malformations back to normal conditions in the lower animal forms on the *scala naturae*; this abnormal reoccurrence of an ancestral trait is an atavism.

Meckel's idea of recapitulation, articulated in his translation of Cuvier's *Leçons d'anatomie comparée* and later works, became called the Meckel-Serres Law [13]. The law was named after Meckel and Etienne Serres [14], a physician at Hôtel-Dieu de Paris in Paris, France. The Meckel-Serres Law [13] became central to a debate over how embryos develop, and later, how embryonic development is related to evolution [15]. Karl Ernst von Baer [16], professor of anatomy at the University of Königsberg, in Königsberg, Germany, rejected the Meckel-Serres Law [13] in his 1828 publication, *Über Entwickelungsgeschichte der Thiere. Beobachtung und reflexion* (*On the Developmental History of the Animals. Observations and Reflections*), and created his own set of laws. These laws became known as von Baer's Laws [17], and state that embryos of a higher animal form do not pass through stages of development in which they resemble lower animal forms; instead, embryos start out generally similar in form and then develop more specific characteristics as the embryos grow. Ernst Haeckel [18], professor of comparative anatomy at the University of Jena [19], in Jena, Germany, contributed to the debate in the 1870s, expanding the Meckel-Serres Law [13] with the inclusion of evolutionary principles, into what became known as recapitulation theory [20], or the biogenetic law [21].

In 1815 Meckel became the editor of the journal, *Deutsches Archiv für die Physiologie* (German Archive of Physiology), run by his mentor, Johann Reil. Under Meckel's control, the journal emphasized empirical study and published pieces on comparative anatomy and embryology [7]. In 1826 the journal's name was changed to *Archiv für Anatomie und Physiologie* (Archive of Anatomy and Physiology), and Meckel stayed on as its editor until his death from liver disease on 31 October 1833.

Sources

1. von Baer, Karl Ernst. *Über Entwickelungsgeschichte der Thiere. Beobachtung und reflexion.* [On the Developmental History of the Animals. Observation and Reflections]. Königsberg: Gebrüdern Borntträger, 1828. http://www.biodiversitylibrary.org/item/28306 [22] (Accessed May 3, 2012).
2. Bergstrom, Carl T., and Lee Alan Dugatkin, eds. *Evolution.* New York: W. W. Norton, 2012.
3. Cuvier, Georges. *Leçons d'anatomie comparée.* [Lessons in Comparative Anatomy] Paris. 1799–1805. http://www.biodiversitylibrary.org/item/104564#page/13/mode/1up [23] (accessed May 3, 2012).
4. Gluecklich, Bernd. "Johann Friedrich Meckel, the Younger (1781–1833)." *The American Journal of Surgery* 132 (1976): 384–6.
5. Gould, Stephen Jay. *Ontogeny and Phylogeny* [24]. Cambridge, MA: Harvard University Press [25], 1977.
6. Hopwood, Nick. "Embryology." In *The Cambridge History of Science Vol. 6: The Modern Biological and Earth Sciences*, eds. Peter J. Bowler and John V. Pickstone, 285–315. Cambridge: Cambridge University [26] Press, 2009.
7. "Johann Friedrich Meckel, the Younger (1781–1833)." *The Journal of the American Medical Association* [27] 214 (1970): 138–9.
8. Meckel, Johann Friedrich. "Über die Divertikel am Darmkanal." [On the Diverticulum of the Intestines] *Reil's Archiv für die Physiologie* [Reil's Archives of Physiology] 9 (1809): 421–53. e+Divertikel+am+Darm+Kanal&hl=en&sa=X&ei=n9miT8aTL4SqiQK80fybDQ&ved=0CC4Q6AEwAA#v=onepage&q=%C3%9Cber%20die%20Divertikel%20am%20Darm%20Kanal&f=false [28] (Accessed May 3, 2012).
9. Opitz, John M., Rüdiger Schultka, and Luminita Göbbel. "Meckel on Developmental Pathology." *American Journal of Medical Genetics* 140A (2006): 115–28.
10. Rieppel, Olivier C. *Fundamentals of Comparative Biology.* Boston, MA: Birkhäuser Verlag, 1988.
11. Risse, Guenter B. "Meckel, Johann Friedrich." *Complete Dictionary of Scientific Biography* 9: 252–3.
12. Tempkin, Owsei. "German Concepts of Ontogeny and History around 1800." *Bulletin of the History of Medicine* 24 (1950): 227–46.

Johann Friedrich Meckel studied abnormal animal and human anatomy in nineteenth century Germany in an attempt to explain embryological development. During Meckel's lifetime he catalogued embryonic malformations in multiple treatises. Meckel's focus on malformations led him to develop concepts like primary and secondary malformations, atavism, and recapitulation-all of which influenced the fields of medicine and embryology during the nineteenth and twentieth centuries.

Subject

Anatomy, Comparative [29] Embryology [30] Meckel, J. F. (Johann Friedrich), 1781-1833 [31] Embryological development [32] Birth defects [33] Fetal development [34] Embryos [35] Embryology [30] Fetus [36] Cuvier, Georges, baron, 1769-1832 [37] Serres, Etienne Renaud Augustin, 1786-1868 [38] Meckel Diverticulum [39]

Topic

People [40]

Publisher

Arizona State University. School of Life Sciences. Center for Biology and Society. Embryo Project Encyclopedia.

Format
Articles [41]

Last Modified
Wednesday, July 4, 2018 - 04:40

DC Date Accessioned
Tuesday, October 15, 2013 - 18:15

DC Date Available
Tuesday, October 15, 2013 - 18:15

DC Date Created
2013-10-11

Source URL: https://embryo.asu.edu/pages/johann-friedrich-meckel-younger-1781-1833

Links
[1] https://embryo.asu.edu/pages/johann-friedrich-meckel-younger-1781-1833
[2] https://embryo.asu.edu/keywords/meckels-diverticulum
[3] https://embryo.asu.edu/keywords/recapitulation
[4] https://embryo.asu.edu/keywords/recapitulation-theory
[5] https://embryo.asu.edu/keywords/meckel-serres-law
[6] https://embryo.asu.edu/search?text=Johann%20Friedrich%20Meckel
[7] https://embryo.asu.edu/search?text=embryology
[8] https://embryo.asu.edu/search?text=University%20of%20Halle
[9] https://embryo.asu.edu/search?text=Georges%20Cuvier
[10] https://embryo.asu.edu/search?text=yolk
[11] https://embryo.asu.edu/search?text=humans
[12] https://embryo.asu.edu/search?text=fetus
[13] https://embryo.asu.edu/search?text=Meckel-Serres%20Law
[14] https://embryo.asu.edu/search?text=Etienne%20Serres
[15] https://embryo.asu.edu/search?text=evolution
[16] https://embryo.asu.edu/search?text=Karl%20Ernst%20von%20Baer
[17] https://embryo.asu.edu/search?text=von%20Baer%E2%80%99s%20Laws
[18] https://embryo.asu.edu/search?text=Ernst%20Haeckel
[19] https://embryo.asu.edu/search?text=University%20of%20Jena
[20] https://embryo.asu.edu/search?text=recapitulation%20theory
[21] https://embryo.asu.edu/search?text=biogenetic%20law
[22] http://www.biodiversitylibrary.org/item/28306
[23] http://www.biodiversitylibrary.org/item/104564
[24] https://embryo.asu.edu/search?text=Ontogeny%20and%20Phylogeny
[25] https://embryo.asu.edu/search?text=Harvard%20University%20Press
[26] https://embryo.asu.edu/search?text=Cambridge%20University
[27] https://embryo.asu.edu/search?text=American%20Medical%20Association
[28] http://books.google.com/books?id=8RIUAAAAQAAJ&pg=PA421&dq=%C3%9Cber+die+Divertikel+am+Darm+Kanal&hl=en&sa=X&ei=n9miT8aTL4SqiQK80fybDQ&ved=0CC4Q6AEwAA
[29] https://embryo.asu.edu/library-congress-subject-headings/anatomy-comparative
[30] https://embryo.asu.edu/library-congress-subject-headings/embryology
[31] https://embryo.asu.edu/library-congress-subject-headings/meckel-j-f-johann-friedrich-1781-1833
[32] https://embryo.asu.edu/library-congress-subject-headings/embryological-development
[33] https://embryo.asu.edu/library-congress-subject-headings/birth-defects
[34] https://embryo.asu.edu/library-congress-subject-headings/fetal-development
[35] https://embryo.asu.edu/library-congress-subject-headings/embryos
[36] https://embryo.asu.edu/library-congress-subject-headings/fetus
[37] https://embryo.asu.edu/library-congress-subject-headings/cuvier-georges-baron-1769-1832
[38] https://embryo.asu.edu/library-congress-subject-headings/serres-etienne-renaud-augustin-1786-1868
[39] https://embryo.asu.edu/medical-subject-headings/meckel-diverticulum
[40] https://embryo.asu.edu/topics/people
[41] https://embryo.asu.edu/formats/articles