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HARVEY, FOETAL IRRITABILITY—AND ALBERTUS MAGNUS

by

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IN his classical *History of Embryology* Joseph Needham rightly accords credit to Harvey for having appreciated tissue irritability as independent of the nervous system before Glisson.[1] This is based on the seventeenth and the fifty-seventh chapters of the work *On generation of animals* (1651).[2] In the latter Harvey deals with *paradoxa* and *problemata*—in the first place that many things seem to happen in the *ovum* before anything of the embryo, nay even its first particle emerges.[3] What then prevents us from believing that the innate heat and vegetative soul exist before the chick itself? On the other hand these are inseparable from the latter and, according to the famous Aristotelian definition of the soul, should be the act of an organic body that is potentially alive. A further *paradoxon* lies in the blood being formed, moved and endowed with vital spirit before any blood-forming or moving organs are in existence. *Nor is it less new and unheard of that sense and motion are in the foetus before the brain is built up: for the foetus is moved, contracts and unfurls itself at a time when at the place of the brain yet nothing is visible but clear water.*[4]

A little later Harvey supplements this, stating that even *a light touch with a needle* will elicit *obscure movements, contractions and contortions* like those of a worm or caterpillar in the very primogenital drop of blood before any trace of a body is discernible and the brain consists of nothing but clear water. Hence it obviously has sensation, and Harvey concludes that as we see motion and sensation to be present

[1] Cambridge, 1934, p. 123.

[2] W. HARVEY, *Exercitationes de generatione animalium*, quoted from ed. Amstelaedami, ap. I. Ravesteynium, 1662, p. 66; p. 242–245; tr. WILLIS, R., *The works of William Harvey*, London 1847, p. 239; p. 428–433; tr. *Anatomical exercitations concerning the generation of living creatures*, London 1653, p. 94–95; p. 344–348.

[3] antequam quippiam pulli, vel ipsa primogenita ejus particula appareat; quidni utique credamus calorem innatum, animamque pulli vegetativam, ante pullum ipsum existere? ed. 1662, p. 242.

[4] videtur praeterea *paradoxon*, Sanguinem fieri et moveri . . . antequam ulla organa sanguifica, vel motiva exstiterint. Nec minus novum, atque inauditum, inesse sensum ac motum in foetu, priusquam cerebrum exstructum fuerit: Movetur enim foetus, contrahit et explicat sese, cum pro cerebro adhuc nihil conspicuum est, praeter aquam limpidam, ed. 1662, p. 243.

in a liquid before the brain is begotten, not all motion and sensation come from the brain.[5]

These observations and conclusions are of great general importance in Harvey's vitalist biological views. They fit in well with other observations and points which Harvey made concerning the blood as a *part* of the organism—a part that deserves this designation as it is endowed with active movement and sensation, i.e. with irritability.[6]

Here again Harvey anticipates Glisson, although characteristic differences can be found which separate his ideas from those of Glisson as well as of Galen. This has been recently established by Temkin who also drew attention to Vesalius' idea of an immanent biological motor force.[7]

Harvey was probably original in observing reactive movements of the foetal *anlage* in its earliest stages, when nothing was visible but the primogenital drop of blood, the site of the brain was occupied by limpid fluid and not even a particle of the embryonic body could be discerned. Even more original is the building in of his observation into the context of the *Paradoxa* which he discusses and the conclusion of the priority of the vital principle, nay of 'mind, providence and intellect which dispose everything forthwith from the first origin for the existence and wellbeing of the chick, put it in order and procure it, and artfully mould the form and resemblance of the parents.'[8]

And yet it would seem pertinent to record in comparison an earlier observation which somewhat foreshadows that of Harvey, although it concerns a much later stage in foetal development. It is found in Albertus Magnus, *De animalibus*.[9] Here abortion and the human foetus are discussed—the latter can be found and examined if care is taken to collect the aborted discharge in a vessel filled with water. The foetus is then found to have the size of a large ant on the fortieth day, and the body with individual members, notably the head can be identified. When it is examined fresh it can exhibit a '*movement of dilatation and constriction when pricked with a needle, whence it is certain that this creature is animated.*[10]

The data given by Albertus concerning the size of the human foetus are based on Aristotle's statement that 'in the case of a male embryo aborted at the fortieth day, if it be placed in cold water . . . the embryo is revealed, as big as one of the large kind of ants; and all the limbs are plain to see, including the penis, and the eyes also . . .'[10a] However, in using the needle to provoke a motor response Albertus

[5] prima quoque corporis fabrica, sive constitutio (quam mucilaginosam diximus) priusquam membra ulla discernuntur, cumque cerebrum nil aliud, quam aqua limpida est, si modo leviter pungatur, instar vermis vel erucae, sese obscure movet, contrahit et contorquit; ut sentire ipsam, evidenter pateat, ed. 1662, p. 245.—Nempe (cum motum et sensum ante natum cerebrum adesse liquido cernamus) manifestum est, non omnem motum atque sensum a cerebro proficisci, ibid. p. 244.

[6] *De generatione animalium*, exerc. LXXI, ed. 1662, p. 322; tr. 1653, p. 458; tr. WILLIS, p. 510. This was concordant with ARISTOTLE, *De part. animal.* II, 2; 648 a, see to this A. L. PECK in his edition (Loeb's Lib.) 1937, p. 28.

[7] O. TEMKIN, 'The classical roots of Glisson's doctrine of irritation', *Bull. Hist Med.*, 1964, 38, 297–328 and *idem*, *Vesalius on an immanent biological motor force*', *Bull. Hist. Med.*, 1965, **39**, 277–80.

[8] *loc. cit.* in note (4) ed. 1662, p. 243; tr. WILLIS, p. 429.

[9] ALBERTUS MAGNUS, *De animalibus*, lib. IX, cap. 3, ed. Venet. 1495, fol. 105 v.

[10] et aliquando quando recenter cecidit invenitur habens motum dilatationis et constrictionis quando acu pungitur propter quod pro certo scitur creatura illa esse animata.—This observation was mentioned as one of the advanced results of Albert's original research by PAUL DIEPGEN, *Frauenkundliches in der Scholastik des XIII. Jahrhunderts, Geb. hilfe u. Frauenhlkde.*, 1949, IX, 245–50.

[10a] *Historia animalium* tr. by D.Arcy Wentworth Thompson in *The works of Aristotle*, tr. ed. J. A. Smith and W. D. Ross, Oxford 1910, lib. VII, cap. 4, 583 b 15.

seems to be original. This goes to show that the human foetus exhibits signs of animation parallel with those of bodily configuration. In significance and purpose Albertus' observation is, therefore, far removed from Harvey's ideas, although the *method* is the same.

It is not unlikely that Harvey was familiar with Albertus' text in which comparative embryology was treated on a broad Aristotelian basis, although Albert deviates in some points from the Philosopher. He was quoted by Harvey, though in a different context and second hand—here Harvey refers to Caesar Cremoninus (1552–1631) who succeeded Zabarella at Padua and is called by Harvey the 'outstanding expert in Aristotelian philosophy'. He strongly opposed Albertus, Harvey continues, for having introduced incorporeal—spiritual—qualities or more divine kinds of heat such as brightness and light. These were supposed to enter the body from outside, by contrast with Harvey's Aristotelian idea of spiritual immanence.[11] Two further places can be adduced from Harvey's anatomical lecture notes in which Albertus Magnus is mentioned—here he is bracketed together with Aristotle, Avicenna and Cardanus and Scotus and Thomas respectively, again suggesting quotation from a secondary source.[12] However, we have every reason to believe that Harvey was well acquainted with scholastic commentators of Aristotle, notably St. Thomas Aquinas, as Wilkie has recently pointed out[13]. We may add that Harvey made use of the Thomistic *nihil est in intellectu quod non antea fuerit in sensu* and that he referred to the Averroistic *intellectus possibilis*.[14,15]

In conclusion, then, Harvey's method in demonstrating tissue irritability as independent of the brain by pricking the embryonic *anlage* with a needle was foreshadowed by an observation of Albertus Magnus in human foetuses, although neither the experimental conditions nor the biological conclusions are comparable.

[11] HARVEY, *De generatione animalium*, exercit. LXXI, ed. 1662, p. 317; tr. WILLIS, p. 504, with ref. to CAESAR CREMONINUS, *De calido innato et semine pro Aristotele adversus Galenum*, Lugd. Batav. 1634, Dictatio VII: reprobatur opinio allata ex Alberto et ex propria sententia et excluditur substantia coelestis a mistionibus elementorum, p. 64–76.

[12] G. WHITTERIDGE, *The anatomical lectures of William Harvey*, Edinburgh and London, 1964, fol. 63 v, p. 220 and fol. 94 r, p. 324. The 'bulk-quotation' of Albertus concerning the ventricular localisation of brain functions is reminiscent of the references given by Vesalius in this matter (*De corporis humani fabrica*, second ed. Basil. 1555, pp. 774 and 792, lib. VII, cap. 1 and 10). The same applies, though to a lesser degree to Vesalius' condemnation of 'Alberti illius magni indoctissimo de Virorum mulierumque secretis libro' (concerning the seven-cell theory of the uterus—ibidem, lib. V, cap. 15, p. 667).

[13] J. S. WILKIE, 'Harvey's immediate dept to Aristotle and to Galen', *Hist. Sci.*, 1965, 4, 103–24, notably p. 104 seq.

[14] WILLIAM HARVEY, *De generatione animalium*, Praef, ed. 1662, sig. x 7; Willis, p. 154.

[15] *Ibid.*, exerc. LXXII, ed. 1662, p. 325; tr. Willis, p. 513.

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