


NOTES AND COMMENTS

TWINS AS MONSTERS: ALBERTUS MAGNUS'S THEORY OF THE GENERATION OF TWINS AND ITS PHILOSOPHICAL CONTEXT*

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 It has often been observed that medieval theoretical medicine and biology derive much of their conceptual apparatus from Aristotle's natural philosophy.¹ It may even be stated that in some cases a thorough understanding of the medieval theories is not possible without a knowledge of this philosophical background. This is especially true for the medieval theory which gives an explanation for multiple births, and which thus pertains to the field of embryology. As will be shown below, this embryological theory is part of a broader philosophical theory which tries to explain monstrosities in Nature.

In this paper my interest will be focused on Albertus Magnus (Albert the Great, c. 1200–1280). Although he was not a physician, Albert holds an important place in the history of medieval medical learning.² In his *De Animalibus*, he presents an explanation of the procreation of twins which provides answers to questions left unanswered by Aristotle's theory.³ In order to appreciate the medieval contribution to the theory of the conception of twins, as well as Albert's specific contribution to that theory, it will be necessary first to explore Aristotle's embryological theory of twins and its philosophical background.

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¹ Cf. Luke Demaitre and Anthony A. Travill, "Human Embryology and Development in the Works of Albertus Magnus," in *Albertus Magnus and the Sciences: Commemorative Essays 1980*, ed. James A. Weisheipl (Toronto: Pontifical Institute of Mediaeval Studies, 1980), pp. 409–10; M. Anthony Hewson, *Giles of Rome and the Medieval Theory of Conception: A Study of the "De formatione corporis humani in utero"* (London: Athlone Press, 1975), pp. 67–149; and Joseph Needham, *A History of Embryology*, 2d ed., rev. with the assistance of Arthur Hughes (Cambridge: Cambridge University Press, 1959), pp. 56–60, according to whom Aristotle had an unfortunate influence on the progress of science. Needham has a low opinion of the medieval developments in embryology (cf. p. 60).

² Nancy G. Siraisi, "The Medical Learning of Albertus Magnus," in Weisheipl, ed., *Albertus Magnus and the Sciences*, pp. 379–81. Albert is the only medieval thinker who is discussed in Needham's *History of Embryology*.

³ There are not many thirteenth-century commentaries on Aristotle's biological works. The commentary Albert is one of the few which is also available in a modern edition: Albertus Magnus, *De animalibus* l. XXVI, ed. Hermann Stadler, in *Beiträge zur Geschichte der Philosophie des Mittelalters* (Münster: Aschendo 1916), vol. 15 (books 1–12) and (1920), vol. 16 (books 13–26).

Aristotle mentions multiple offspring in his *Historia animalium* and *De generatione animalium*. The relevant passages in these works reveal that the concept of superfoetation plays a basic role in his theory of twins, which may best be illustrated by the legend of the conception of Hercules and Iphicles.⁴ According to this legend, Alcmena, once upon a time, was seduced by Zeus, who on this occasion had disguised himself as Alcmena's husband, Amphitryon. The next day Amphitryon returned home and also paid a visit to his wife. Both "visits" resulted in conception, and shortly afterwards Alcmena gave birth to twins: Hercules, son of Zeus, and Iphicles, son of Amphitryon.⁵ This legend is an example of successful superfoetation, that is, where a woman is impregnated more than once in the same cycle. Another instance of superfoetation reported by Aristotle is that of the adulterous wife who gave birth to twins, one resembling her husband, the other her lover.⁶ For superfoetation to be successful, the interval between the first and the second conception should not be too long; otherwise the second embryo will be aborted.⁷

Of course, the development of more than one fetus may also be induced by one partner, or even after one mating. The description of polyembryony resulting from the last circumstance conforms most to modern ideas and forms the central part of Aristotle's theory.⁸

According to Aristotle, all natural generation involves form (*eidos*) and matter.⁹ The specific form which the offspring is to have is contributed by the male, and in this way the male acts as the formal cause in the process of generation. The female provides the raw material which is capable of being the vehicle of this specific form, and in this way she acts as the material cause. The male and female contributions are the semen and the menstrual blood or *katamenia* (*menstrua*). The semen, being a "residue" of the blood, contains the form which shapes the female matter. The semen does not itself become part of the offspring, but evaporates. It only acts as a medium to transfer the form into the matter. In this context, Aristotle compares the generation of offspring with the production of artifacts by a car-

⁴For the survey of Aristotle's theory of twins, I used the following editions: *Historia animalium*, trans. D'Arcy Wentworth Thompson (London: Oxford University Press, 1956); *De generatione animalium*, trans. Arthur Platt (London: Oxford University Press, 1958); *De partibus animalium I* and *De generatione animalium I*, trans. and annotated by David M. Balme (Oxford: At the Clarendon Press, 1972); and *De generatione animalium: Translatio Guillelmi de Moerbeka*, ed. H.J. Drossaart Lulofs in *Aristoteles Latinus* (Bruges and Paris: Desclée de Brouwer, 1968).

⁵In *Hist. animal.* 7.584a.13–15, Aristotle refers to this legend.

⁶*Ibid.* 585a.12–17.

⁷After conception, during the period of gestation, the uterus is supposed to close. Cf. *De gen. animal.* 773b.15 and following. In *Hist. animal.*, Aristotle reports that the first, and not the second, embryo will be destroyed. He adds that if a pregnant woman cohabits after the eighth month, the child born will in most cases be covered with a slimy fluid (cf. 585a.23–25).

⁸In fact it is only one of the possible variations of superfoetation. The discussion of twins in *Hist. animal.* 7.4 is limited to superfoetation due to different copulations. In *De gen. animal.* 773b.6 and following, superfoetation by one single act of sexual intercourse is discussed.

⁹Aristotle, *Metaphysica*, trans. William D. Ross, 2d ed. (London: Oxford University Press, 1928) 1034a.21–b.1; 1044a.32–1044b.1.

penter. The male's role in generation is like that of a carpenter who uses tools to shape the raw material into a product.¹⁰ At other places the formation of an embryo is compared with the process of making cheese: the spermatic secretion acts upon the female menstrual blood like the rennet acts upon the milk.¹¹

An embryo is conceived when the proper proportions of the male and the female contributions are present. A shortage or excess of one or both liquids prevents conception. Animals produce many young after one coitus when there is an abundance of male sperm and female matter. At this point in the theory, the comparison between the seed and the rennet is no longer valid, as Aristotle himself points out.¹² More rennet does not make two cheeses out of one. There also is a qualitative component in the semen, that is to say, the setting agent, which is indivisibly and completely present in each parcel of semen after the physical semen has been divided.¹³ So, two factors play a role in the process of generating twins: abundance and division.

The Aristotelian explanation of the generation of twins is completely different from the one presented in *De natura pueri* of the Hippocratic corpus. There, the generation of manifold offspring is related to the manifold structure of the womb: during one single coitus the different "cells" (*receptacula/cellulae*) of the uterus are filled with male semen, which is emitted during successive spasms.¹⁴ The text remains silent on the number of cells in the womb, but there exists a tradition in which this number is seven: three cells for the generation of girls, three for boys, and one, in the middle of the womb, for hermaphrodites.¹⁵

This, then, is the medical part of Aristotle's theory. Let us move on to the philosophical component, which proved so influential in medieval medicine and biology.

¹⁰ *De gen. animal.* 1.730b.1–25.

¹¹ *De gen. animal.* 1.729a.10–15 and 4.771b.15 and following. Aristotle refuted the theory that not only the male, but also the female, contributes seed (cf. *De gen. animal.* 729a.22–33 and the lucid commentary of Balme, in the Oxford University Press edition [1972], p. 151). A short discussion of Aristotle's theory and the two-seed theory is given in Needham, *History of Embryology*, pp. 42–43. The theory that the female also emits seed may be found in Hippocrates' *On Generation*, chap. 5. Cf. Iain Lonie, *The Hippocratic Treatises "On Generation," "On the Nature of the Child," "Diseases IV": A Commentary* (Berlin: Walter de Gruyter, 1981), p. 3, and his commentary on p. 123. A summary of Aristotle's embryological theory is provided in Anthony Preus, *Science and Philosophy in Aristotle's Biological Works* (Hildesheim: Georg Olms, 1975), pp. 48–64. Johannes Morsink, *Aristotle on the Generation of Animals: A Philosophical Study* (Washington, D.C.: University Press of America, 1982) interprets *De gen. animal.* as being in dialectical opposition to the two Hippocratic treatises *On Semen* and *On the Nature of the Child*.

¹² *De gen. animal.* 772a.1–37. On 774b.1–3. Aristotle observes that hairy men more than smooth men are given to sexual intercourse and have much semen.

¹³ See Wolfgang Kullmann, *Die Teleologie in der aristotelischen Biologie* (Heidelberg: Carl Winter Universitätsverlag, 1979), pp. 56–57, for a good summary of the problem and its context. Aristotle developed his theory in *De gen. animal.* 728b.32–729a.20. Cf. also the commentary of Balme, p. 151, on this passage. Aristotle developed this theory within a controversy over the pangenes theory.

¹⁴ Lonie, *Hippocratic Treatises*, pp. 21 and 253–54.

¹⁵ See Fridolf Kudlien, "The seven cells of the uterus: the doctrine and its roots," *Bull. Hist. Med.*, 1965, 49: 415–23, for the sources of the tradition of the seven-celled uterus.

Surprising from a modern point of view is that, in *De generatione animalium*, Aristotle presents his theory of the generation of twins against the background of an exposition of the generation of *monstra* in general. The implication made here is clear: twins are some kind of monsters.¹⁶ By monsters, Aristotle does not just mean creatures which, due to some pathological process, are misshapen, but, much more generally, all creatures which are out of the ordinary in the sense that they are not the result of the common course of Nature. To use medieval terminology, monsters are creatures beyond the range of Nature (*praeter naturam*). They are the faults of nature (*peccata naturae*).

The notion of *monstrum* has a place within the context of Aristotle's teleology: Nature always acts for the sake of ends (*causa finalis*). This purposiveness of Nature is manifest when animals like spiders build webs and swallows build nests as if their doing so were the work of reason. In reality, these actions are the manifestations of the final cause which is at work in Nature. Sometimes, however, the purposiveness of Nature may be faulty; then, due to certain causes, the intended end (*finis*) may not be achieved, and in that case the outcome of a natural process is called a monster.¹⁷

Aristotle's teleology depends upon the observed regularity of Nature. If something irregular happens, that is, something outside the common course of Nature, we know that the purpose was not achieved. The common course of Nature is identified with those occurrences which, according to observation, are most frequent. So, a monster is not only the outcome of a corrupted natural process, but also an outcome which does not occur very often. From the thirteenth century onward, after Aristotle's works became known in the West, this view of the natural order of the world was the accepted view. The medieval expressions *praeter naturam* (outside Nature's common course) and *praeter ut in pluribus* (outside that which occurs frequently) are mutually interchangeable.¹⁸

Against this background it is clear why twins are considered to be monsters. The birth of twins is something exceptional. It is a phenomenon much like the birth of an infant who has eleven fingers. Nearly always (*ut in pluribus*) a human being has ten fingers, but sometimes (*ut in paucioribus*) a human being may have eleven fingers. In the latter case, however, something has gone wrong in the common course of the causal nexus.

¹⁶ *De gen. animal.* 771a.15 and following.

¹⁷ Cf. Aristotle, *Physica*, trans. Robert P. Hardie and R. K. Gaye (London: Oxford University Press, 1930), 2.8, and especially 199a.33–199b.27.

¹⁸ *De gen. animal.* 770b.9–11: "Est autem monstrum aliquid eorum que preter naturam, preter naturam autem non omnem, sed eam que ut in pluribus." Cf. also 772a.35–772b.1. For a discussion of Aristotle's teleology I refer the reader to Balme, pp. 93–98; Kullmann, *Die Teleologie*; Preus, *Science and Philosophy*, pp. 183–221; and Richard Sorabji, *Necessity, Cause, and Blame: Perspectives on Aristotle's Theory* (London: Duckworth; Ithaca, New York: Cornell University Press, 1980), pp. 143–85. See Anneliese Maier, *Die Vorläufer Galileis im 14. Jahrhundert: Studien zur Naturphilosophie der Spätscholastik* (Rome: Edizioni di storia e letteratura, 1949), pp. 223–29, for the related medieval theory of necessity and contingency in works not biological.

Aristotle even argues that both the unnatural multiplication of body parts (like fingers) and the birth of twins are caused by an abundance of matter.¹⁹ The only difference is that in the case of twins, there is also a *division* of that matter. He remains silent on the causes of that division.²⁰

It is at this point that Albert the Great makes his contribution to the theory of the generation of twins. In *De animalibus* 18.2.2, which is a commentary on Aristotle's theory of twins as explained in *De generatione animalium*, Albert in fact summarizes his own theory of twins.²¹ Like Aristotle, he is of the opinion that the generation of twins is caused by abundance (*superfluitas*) and division (*divisio*) of matter. Unlike Aristotle, however, he briefly enumerates the causes of the division of the matter before referring his readers to another part of his work, where he has treated this subject more completely (*sicut in antehabitis huius scientiae determinatum est a nobis*). Without doubt, Albert is referring here to *De animalibus* 9.2.6. This chapter, a digression within Albert's commentary on Aristotle's *Historia animalium*, is devoted to a causal explanation of the division of the matter.

My exposition of Albert's theory of twins will concentrate on *De animalibus* 9.2.6 for two reasons: (1) the theory expounded in this digression is a genuine contribution to Aristotle's theory, and (2) this text provides an opportunity to clarify its philosophical background, especially in connection with Albert's notion of monsters.²² First I will discuss the embryological part of Albert's theory.

In his theory of twins, Albert attributes an important role to the division of matter, or, perhaps better, the division of the generative material (*materia generationis*). The *materia generationis* is the mixture of the male and female contributions to the product of conception. This mixture is also called *sperma* by Albert. Note, however, that in the text I am using, the term *sperma* is used interchangeably for the mixture (zygote) as well as for either the male or the female contribution. In *De animalibus* 9.2.6, Albert enumerates the causes for this division. He distinguishes between causes which originate with the male and causes which originate with the female.

The first cause of the division of the generative material is the fact that

¹⁹ *De gen. animal.* 772b.13–17.

²⁰ *Ibid.* 773a.1–3.

²¹ Albert's *De animalibus* is a running commentary on Aristotle's biological corpus. Books 1–10 are a paraphrase of Aristotle's *Historia animalium*; books 11–14 of Aristotle's *De partibus animalium*, books 15–19 of Aristotle's *De generatione animalium*. Books 20–26 are Albert's own additions. Aristotle's biological treatises were, before 1220, translated from the Arabic into Latin by Michael Scot and, in 1260, from the Greek into Latin by William of Moerbeke. Albert used the Scot translation. For the history of the Latin Aristotle, see Bernard Dod, "Aristoteles Latinus," in *The Cambridge History of Later Medieval Philosophy*, ed. Norman Kretzmann, Anthony Kenny, and Jan Pinborg (Cambridge: Cambridge University Press, 1982), pp. 58–59, 63, 67.

We also possess Albertus Magnus, *Quaestiones super de animalibus*, ed. Ephrem Filthaut in *Opera omnia*, 12 (Münster: Aschendorff, 1951–). In this work no mention is made of Albert's theory of twins. The work is a report (*reportatio*) made by Conrad of Austria and probably was not authorized by Albert.

²² Of course Albert was also familiar with Aristotle's theory of superfœtation. According to this theory the generation of twins is due to successive conceptions (*impregnari una impregnatione post aliam*). Cf. *De animal.* 9.1.5. As I have already indicated, superfœtation is only one aspect of the explanation of the generation of twins.

the male sperm is not emitted in a continuous flow, but in successive impulses (*impulsiones*) which diminish in force; in this way, sperm reaches different parts of the womb. The “impulses” of male sperm are attributed to “interruptions of the spirit,” which are due to the fact that the “spirit” has to come from different parts of the body. From other texts it is clear that Albert conceives *spiritus* as an instrument which conveys the biologically essential virtues from the principal parts of the body (heart, liver, and brain) to the rest of the body. The “spirit” is separated from the soul only in a functional sense, not ontologically.²³ In our context, the operation of the “spirit” is necessary to animate the embryo. If the vagina is too long, impregnation may be impeded by the fact that the “spirit” of the semen has evaporated en route.²⁴

The three other factors which contribute to the separation of generative matter are brought about by the female. The first is analogous to the cause of the division of the male sperm. The female liquid, which the physicians call *sperma mulieris*, is also sent out in successive parcels. By “female sperm,” Albert probably means the vaginal secretion. Note that Albert, in contradistinction to Aristotle, is of the opinion that the female does contribute “semen” to the embryo, although this semen has no formative virtue.²⁵

Secondly, the division is caused by the way the male sperm is “sucked in” by the uterus (*gluttitio matricis*). Sometimes the male sperm is taken in by the womb in successive turns, and then each quantity of sperm absorbed may reach a different part of the womb.

Finally, the sperm (here in the sense of the male and female contributions to the zygote) may be divided by the way the female, during coitus, moves her uterus for her delectation. Albert informs us that the causes of enjoyment of the female during sexual intercourse are threefold: the secretion of the female sperm (*projectio*); the absorption of the male semen (*gluttitio*); and, finally, the movements of the womb. This last kind of enjoyment is induced by the fact that the glans penis (*collum vesicae*) is grasped by the womb (*vulva*).

It is remarkable that the *projectio* and the *gluttitio*, which are here enumerated among the sources of sexual pleasure for the female, are precisely the two other causes of the division of the *sperma* (zygote). So, to summarize Albert’s position, it is mainly due to the delectation of the female that the division of the sperm, that is, of the generative material, and thus the generation of twins, is brought about.

Other passages in *De animalibus* give the impression that Albert has

²³ See James Bono, “Medical spirits and the medieval language of life,” *Traditio*, 1984, 40: 119–26, for an extensive discussion of Albert’s notion of spiritus and its historical background. See also Demaitre and Travill, “Human Embryology,” pp. 422–24, for some observations on Albert’s theory of animation within the confines of embryology.

²⁴ *De animal.* 16.2.1 and 2.

²⁵ See also Demaitre and Travill, “Human Embryology,” pp. 417–19, for other passages in the work of Albert which suggest that Albert distinguishes components in the female contribution which Aristotle had left undifferentiated as the catamena.

developed a theory of “the mechanism” of sexual delight for the female. Albert relates the female delectation during intercourse with the anatomical structure of the vagina. The vagina consists of muscular tissue (*caro nervosa*), and for this reason it is perceptive to delight (*sensibilis dilectionis*).²⁶ The delight is induced by the fact that the sinews of the womb are prickled by the sperm (male and female) which is poured over them.²⁷ The state of sexual arousal may even reach such a level that the accompanying movements of the womb tear loose a fetus from its roots and membranes. At the moment that the womb opens itself to “suck in” (*sugit*) the new sperm, the former fetus is aborted.²⁸ Here the movements of the womb are again associated with female sexual delight.

Before turning to the sources of Albert’s theory of the generation of twins in *De animalibus* 9.2.6, I shall elaborate on its philosophical background. We have already noted that, according to the Aristotelian theory, twins fall within the category of monsters: they are something out of the ordinary. Twins are the result of a corruption of a natural process. The tendency, already perceptible in Aristotle, to attribute this corruption to the matter which is involved in the generation of twins becomes very distinct in Albert’s theory. The fact that Albert, in his embryological theory, works out this particular aspect is bound to be illuminated by a discussion of his theory of monsters in general.

The most profound exposition on monsters may be found in Albert’s commentary on book 2 of Aristotle’s *Physics*. Book 2 contains, among other things, the well-known discussion concerning whether Nature acts for an end. One of the “proofs” that Nature does act for a purpose is the fact that otherwise one could not speak about the faults of Nature: “For, everything which happens in the correct way, possesses this correctness with regard to an end it is due to accomplish, and when it fails, its failure is attributable to the fact that, due to the corruption of a natural principle, it has not accomplished its end.” The failures of natural processes which are for a purpose but which do not accomplish this purpose are in this context considered monsters.²⁹

After presenting this definition, Albert surveys the causes of the failure of a natural process. He distinguishes four main categories of causes—and subdivides each—all of which have something to do with the disposition of the matter on which an agent acts. Diminution of matter (*materiae diminutio*), abundance of matter (*materiae superfluitas*), disproportion of matter

²⁶ *De animal.* 2.2.4. Albert’s observations on the intricacies of female sexual delight have no counterpart in the text of Aristotle. Cf. *Hist. animal.* 3.510b.13.

²⁷ *De animal.* 9.1.5. This information is not to be found in Aristotle. Cf. *Hist. animal.* 3.510b.13.

²⁸ *De animal.* 9.1.5. This passage also has no counterpart in Aristotle.

²⁹ Albertus Magnus, *Physica* 2.3.3.; *Opera omnia*, 3, ed. A. Borgnet (Paris: Vives, 1890–99), p. 166: “Similiter utique fiet in physicis: quia quidquid ibi recte fit, non habet rectitudinem, nisi ex proportione ad finem debitum quem attingit: et cum peccat, peccatum suum perpenditur ex hoc quod finem illum non attingit propter corruptionem alicuius principii naturalis. Monstra enim sunt peccatum illius quod in natura est propter aliquid.” On p. 168: “Omnia enim haec monstra peccata naturae sunt intendentis finem aliquem quem attingere non valet propter corruptionem alicuius principii naturalis.”

with regard to the qualities conveyed upon it (*qualitatum disproportionabilitas ad materiam*), and a deficiency of the container (*continentis malitia*)—all may prevent the achievement of the purpose of a natural process.

In his discussion of the category “monsters due to abundance—in number and in magnitude—of matter,” we encounter Albert’s theory of twins as an illustration. Abundance and division of sperm in the womb causes the birth of twins. The division of the sperm, that is, the matter from which the product of conception is made, is induced by the movements made by the female during mating. Albert adds that if the division of the sperm is not completed, the twins will be conjoined.³⁰ Albert’s commentary on the *Physics* illustrates the place of his theory of twins within the broader framework of his theory of teratogenesis.

It is important to stress that Albert considers monsters to be phenomena which belong to natural philosophy: they have a natural explanation. His attitude toward abnormal births resembles very much the reflections of Francis Bacon on the study of monsters. Bacon gave the study of monsters a place within his program for the reform of human knowledge, developed in *The Advancement of Learning*.³¹

The idea that the corruption of a natural process is caused by the matter involved recurs in other works of Albert’s. It is most boldly stated in *De animalibus* 18.1.6: “There is no cause of monstrosity other than matter” (*Causa monstruositatis non est nisi in materia*).³² Although Aristotle also seems to blame matter for the generation of monsters, he does not develop the idea as fully as does Albert.³³ The extensive etiology of monsters discussed above is lacking in Aristotle’s text of the *Physics*.

It is possible that Aristotle’s belief that the male semen cannot be the cause of monstrosities induced Albert to develop his etiology of abnormal births in the way indicated above. In *De generatione animalium* 4.4 (769b.10–770a.10), Aristotle attacks Democritus’s theory of teratogenesis. Aristotle informs us that Democritus attributes the generation of monstrosities to the fact that two emissions of semen meet. Not only embryos whose parts are grown together, but also man-headed calves and other things seem to be explained in this way by Democritus. Aristotle ripostes that abnormal births of the category where several species are mixed in one offspring can never be caused by a mixing of seminal fluids, because each species has its own period of gestation.

³⁰ Jennifer Lynn Calagan, “The conjoined twins born near Worms, 1495,” *J. Hist. Med.*, 1983, 38: 450–51, draws attention to what apparently is the earliest documented case of craniopagus twins (1495), a rare type of conjoined twins.

³¹ See Katharine Park and Lorraine Daston, “Unnatural conceptions: the study of monsters in sixteenth- and seventeenth-century France and England,” *Past and Present*, 1981, 92: 20–54, for a discussion of Bacon’s notion of monsters and its (modern) intellectual context.

³² Cf. also *Commentarii in 1–4 Sententiarum* 2. dist.18G.art.5, in *Opera omnia*, 27, ed. A. Borgnet and *Quaestiones de animalibus* 18, quaestiones 5 and 6. A good discussion of the astrological explanation of abnormal births in the works of Albert the Great is presented in Demaitre and Travill, “Human Embryology,” pp. 434–37. The role of matter in the generation of aberrant offspring is, unfortunately, not discussed by them. In my opinion, matter is the most important factor in Albert’s theory of teratogenesis.

³³ Cf. *De gen. animal.* 4.770a.5–10 and *Metaph.* 6.1027a.10–15.

It is remarkable that Albert, in all those passages where he insists that the matter is responsible for monstrosities, cites with approval this opinion of Aristotle.³⁴ The purport of the citations seems to be that a mixing of semen (*commixtio spermatum*) from animals of different species is not possible, and that for this reason the male semen alone cannot be the cause of an abnormal birth.

Perhaps it is useful at this point to compare this notion of monsters with the idea of monsters which was dominant in seventeenth-century New England. In a very interesting article which treats homosexuality and bestiality in Puritan New England, the author examines, among other things, two cases where people were executed on the evidence of buggery.³⁵ In both cases the evidence consisted of a deformed fetus of an animal, "a prodigious monster." Unfortunately, some people saw a resemblance between the fetuses and the poor suspects. Apparently the Puritans believed that it was possible for a man to impregnate an animal. This opinion was not shared by Albert.³⁶

Albert's theory of monstrous births clearly forms the backbone of his theory of twins. I shall now return to the latter, and shall discuss the question of its sources, especially those developed in *De animalibus* 9.2.6. We already observed that Albert's source certainly was not Aristotle, for Aristotle remains silent regarding the causes of the division of the matter, which is fundamental to the process of generating twins. Are Albert's observations on the "technical" sexual details of the generation of twins derived from some other source, or are they another instance of his much-appreciated empirical approach?³⁷

I think the former is the case. From the footnotes of Stadler's edition of *De animalibus*, it is abundantly clear that Albert constantly used Avicenna's *De natura animalium* and the *Liber Canonis*. According to one expert in the field of medieval medical learning, Albert was one of the pioneers in the Latin West in the use of Avicenna as a medical authority.³⁸ Although Albert, in his digression on twins, does not refer to Avicenna (neither does Stadler), it is highly probable that he derived the essentials of his theory of twins from Avicenna. The *De natura animalium* and the *Liber Canonis* contain remarks on the generation of twins which are very similar to those of

³⁴ Cf. *Phys.* 2.3., p. 168; *Sent.* 2. dist.7.F.art.9, p. 158; *De animal.* 18.1.6.

³⁵ Robert Oaks, "Things fearful to name: sodomy and buggery in seventeenth-century New England," *J. Soc. Hist.*, 1978, 12: 268-81.

³⁶ Oaks assumes, however incorrectly, that the Puritans, with their man-like creatures, were not far removed from the Middle Ages. I hope that my discussion of teratogenesis has made it clear that, on this evidence, these two people would never have been accused of buggery in the Middle Ages.

³⁷ James Rochester Shaw, "Albertus Magnus and the Rise of an Empirical Approach in Medieval Philosophy and Science," in *By Things Seen: Reference and Recognition in Medieval Thought*, ed. David Jeffrey (Ottawa: University of Ottawa Press, 1979), discusses some aspects of Albertus Magnus's empirical approach to sexual anatomy and physiology. This contribution is an almost verbatim reproduction of James Rochester Shaw, "Scientific empiricism in the Middle Ages: Albertus Magnus on sexual anatomy and physiology," *Clio Medica*, 1975, 10: 53-64.

³⁸ This is the opinion of Siraisi, "Medical Learning," pp. 392-93.

Albert. Thus, I doubt that Albert's observations stem from his own experience. Rather, this is another instance of Albert's use of Avicenna.

Like Aristotle, Avicenna is of the opinion that the overabundance of sperm, and the apportionment of this sperm—taken here in the sense of the mixture of the male and the female contributions to the product of conception—over several parts of the uterus, is decisive for the process of generating twins. He also enumerates the same factors for the division which Albert does: on the part of the male, the distinct impulses of the semen (*diversi impulsus spermatis*), and on the part of the female, the three circumstances which contribute to her sexual delight; that is, the ejaculations (*eiectiones spermatis*), the movements of the orifice of the womb when it draws in the semen (*motus orificii matricis in sugendo*), and the movements of the womb (*motus matricis*).³⁹ We may safely assume that Albert in his theory of twins relied on *De natura animalium* rather than on the *Liber Canonis*.

I hope this paper has illuminated not only a medieval theory of the generation of twins, but also its philosophical context. The philosophical background essentially consisted of a general theory of teratogenesis, into which the embryological theory of the generation of twins was made to fit. Albert seemingly assimilated Arabic sources in order to develop Aristotle's theory. The way Albert fashions the remarks of Avicenna into a systematic exposition is striking.

Albertus Magnus's theory of the generation of twins did not remain untouched. It was undoubtedly taken up by the philosopher John of Jandun (1285/89–1328), and further research may uncover more followers of Albert on this point.⁴⁰ In his commentary on book 2 of the *Physics*, once again in connection with the discussion of whether Nature acts with a purpose, John of Jandun refers to Albert's theory of twins. Like Albert, he also remarks that sometimes the division of the sperm is not completed, in which case a creature with two heads or four limbs will result. Anxiety that such a terrible thing might happen probably induced him to add the following personal note: "Therefore it is dangerous that the female moves during sexual intercourse in the way prostitutes are reputed to do, because if at such moment they would conceive, they could generate an awful two-headed monster."⁴¹

³⁹ Avicenna, *Liber Canonis* (Venice, 1508; reprint, Hildesheim: Georg Olms, 1964), f.362, and Avicenna, *De natura animalium* (Opera Philosophica) (Venice, 1508; reprint, Louvain: Edition de la bibliothèque S.J., 1961).

⁴⁰ Another author who may have been influenced by Albert is Giles of Rome. See, for this suggestion, Michael McVaugh in his review of Anthony Hewson's *Giles of Rome* in *Speculum*, 1977, 52: 987–89. Unfortunately, the discussion which Hewson (*Giles of Rome*, p. 180) devotes to this particular aspect of embryology is too superficial to provide a definite answer. It is also possible that Giles derived his knowledge directly from Avicenna.

⁴¹ John of Jandun, *Quaestiones super octo libros Physicorum Aristotelis* (Venice, 1551; reprint, Frankfurt: Minerva, 1969), 2.q.13.f.39rb: "Ideo periculosum est et inconveniens quod mulier in coitu agitet se et moveatur, sicut dicuntur facere mulieres meretrices, quia, si tunc conciperent, posset generari monstrum bicorporum et valde turpe et horribile."