# Mother's Milk and the Offspring

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"An houre, [honor?][1] were not I thine onley nurse, I would say thou had'st suckt wisedome from thy teat."

*Romeo and Juliet,* I.3, 1623 Folio.

THE discovery of the milk agent[2] in the etiology of adenocarcinoma of the mammary gland in mice has changed, considerably, ideas concerning the fundamental nature of this neoplasm. The idea, however, that the characteristics or contents of the milk may influence the offspring is an old one. Ehrlich in 1892[3] reported that antibodies could be transmitted through the milk. This observation has been verified by Culbertson (1940)[4] and by Berry and Slavin (1943).[5]

An attempt to trace historically the origin of the idea that the mother or wet nurse could influence the offspring through the milk soon revealed that it was lost in ancient times. During this survey I decided to read again Burton's *Anatomy of Melancholy* (1628)—that storehouse of vast medieval and classical learning. The search was not in vain. The following quotation is taken from the 1826 edition of the *Anatomy* edited by Democritus Junior[6] in the section on the study of the Causes of Melancholy:

*Non-necessary, remote, outward, adventitious or accidental causes: as first from the Nurse, etc.*

Of those remote, outward, ambient, necessary causes, I have sufficiently discoursed in the precedent member. The non-necessary follow; of which (saith Fuchsius) no art can be made, by reason of their uncertainty, casualty, and multitude; so called not-necessary, because (according to

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1 Modern commentaries (Clark and Wright, American ed.) render "houre" of the 1623 folio as "honor." However, the original "houre" was used "somewhat indefinitely for a short or limited space of time, more or less than an hour" (*Oxford English Dictionary*) and should probably be retained. It appears in this sense in another part of *Romeo and Juliet,* "Sad houres seeme long" (I.1.167).

2 Bittner, J. J. Some possible effects of nursing on the mammary gland tumor incidence in mice. *Science,* 1936, *84,* 162. See also Breast cancer in mice as influenced by nursing. *J. nat. Cancer Inst.,* 1940, *1,* 155-168.

3 Ehrlich, P. Ueber Immunität durch Vererbung und Säugung. *Z. Hyg. InfektKr.,* 1892, *12,* 183-203.

4 Culbertson, J. T. The natural transmission of immunity against *Trypanosoma duttoni* from mother mice to their young. *J. Immunol.,* 1940, *38,* 51-66.

5 Berry, G. P. and Slavin, H. B. Studies on herpetic infection in mice. I. Passive protection against virus inoculated intranasally. *J. exp. Med.,* 1943, *78,* 305-313.

6 Burton, Robert. *The anatomy of melancholy,* by Democritus, Junior. London, 1826.

Fernelius) they may be avoided, and used without necessity. Many of these accidental causes, which I shall entreat of here, might have well been reduced to the former, because they cannot be avoided, but fatally happen to us, though accidentally, and unawares, at some time or other: the rest are contingent and evitable, and more properly inserted in this rank of causes. To reckon up all, is a thing unpossible; of some therefore most remarkable of these contingent causes which produce melancholy, I will briefly speak, and in their order.

From a childs nativity, the first ill accident that can likely befall him in this kind, is a bad nurse, by whose means alone he may be tainted with this malady from his cradle. Aulus Gellius brings in Phavorinus, that eloquent philosopher, proving this at large, that there is the same vertue and property in the milk as in the seed, and not in men alone, but in all other creatures. He gives instance in a kid and lamb: if either of them suck of the others milk, the lamb of the goates, or the kid of the ewes, the wooll of the one will be hard, and the hair of the other soft. Giraldus Cambrensis confirms this by a notable example, which happened in his time. A sow-pig by chance sucked a brach [hound dog], and, when she was grown, would miraculously hunt all manner of deer, and that as well, or rather better, than any ordinary hound. His conclusion is, that men and beasts participate of her nature and conditions, by whose milk they are fed. Phavorinus urgeth it farther, and demonstrates it more evidently, that if a nurse be misshapen, unchaste, unhonest, impudent, drunk, cruel, or the like, the child that sucks upon her breast will be so too: all other affections of the mind, and diseases, are almost ingraffed, as it were, and imprinted in the temperature of the infant, by the nurses milk, as pox, leprosie, melancholy, &c. Cato, for some such reason, would make his servants children suck upon his wives breast, because, by that means, they would love him and his the better, and in all likelihood agree with them. A more evident example that the minds are altered by milk, cannot be given, than that of Dion, which he relates of Caligula's cruelty; it could neither be imputed to father nor mother, but to his cruel nurse alone, that anointed her paps with blood still when he sucked, which made him such a murderer, and to express her cruelty to an hair; and that of Tiberius, who was a common drunkard, because his nurse was such a one. *Et si delira fuerit* (one observes), *infantulum delirium faciet;* if she be a fool or a dolt, the child she nurseth will take after her, or otherwise be misaffected; which Franciscus Barbarus proves at full, and Ant. Guivarra: the child will surely participate. For bodily sickness, there is no doubt to be made. Titus, Vespasian's son, was therefore sickly, because the nurse was so (Lampridius): and, if we may believe physicians, many times children catch the pox from a bad nurse (Botaldus). Besides evil attendance, negligence, and many gross inconveniences, which are incident to nurses, much danger may so come to the child. For these causes Aristotle, Phavorinus, and Marcus Aurelius, would not have a child put to nurse at all, but every mother to bring up her own, of what condition soever she be; for a sound and able mother to put out her child to nurse, is *naturae intemperies* (so Guatso calls it): 'tis fit therefore she should be nurse her self; the mother will be more careful, loving and attendant, than any servile woman, or such hired creatures; this all the world acknowledgeth: *convenientissimum est* (as Rod. a Castro, *de nat. mulierum, lib.* 4. c. 12, in many words confesseth) *matrem ipsam lactare infantem,* (who denies that it should be so?) and which some women most curiously observe; amongst the rest, that queen of France, a Spaniard by birth, that was so precise and zealous in this behalf, that when,

in her absence, a strange nurse had suckled her child, she was never quiet till she had made the infant vomit it up again. But she was too jealous. If it be so, as many times it is, they must be put forth, the mother be not fit or well able to be a nurse, I would then advise such mothers (as Plutarch doth in his book *de liberis educandis,* and S. Hierome, *lib.* 2. *epist.* 27. *Laetae de institut. fil.* Magninus, *part.* 2. *Ref. sanit. cap.* 7, and the said Rodericus) that they make choice of a sound woman, of a good complexion, honest, free from bodily disease, if it be possible, and all passions and perturbations of the mind, as sorrow, fear, grief, folly, melancholy: for such passions corrupt the milk, and alter the temperature of the child, which, now being *udum et molle lutum,* is easily seasoned and perverted. And if such a nurse may be found out, that will be diligent and careful withall, let Phavorinus and M. Aurelius plead how they can against it, I had rather accept of her in some cases than the mother her self; and (which Bonacialus the physician, Nic. Biesius the politician, *lib.* 4. *de repub. cap.* 8. approves) some nurses are much to be preferred to some mothers. For why may not the mother be naught, a peevish drunken flurt, a waspish cholerick slut, a crazed piece, a fool, (as many mothers are) unsound, as soon as the nurse? There is more choice of nurses than mothers; and therefore, except the mother be most vertuous, staid, a woman of excellent good parts, and of a sound complexion, I would have all children, in such cases, committed to discreet strangers. And 'tis the only way (as by marriage they are engrafted to other families) to alter the breed, or, if any thing be amiss in the mother, (as Ludovicus Mercatus contends, *Tom.* 2. *lib. de morb. haered.*) to prevent diseases and future maladies, to correct them and qualifie the childs ill-disposed temperature, which he had from his parents. This is an excellent remedy, if good choice be made of such a nurse.

Apparently, the concept that the nurse through her milk could influence the characteristics of the offspring was held by the astute Bacon since, in discussing the topic of the "passages of sympathy between persons of near blood; as parents, children, brothers, sisters, nurse-children, husbands, wives, etc.," he includes the nurse among close relatives.

The development of Weismannian, DeVriesian, and Mendelian biology has discredited any transmission of characteristics except through the genes. We have been taught that the genes are "the differential determiners of heredity" and to look upon them as having exclusive capacity of determining the offspring.

Thus biology has thrown out, and rightly, the ancient and medieval ideas of prenatal impressions, etc. Many observations and pseudo-observations handed down from generation to generation, such as those quoted by Burton, have also been ruled out. This has been due in no small degree to the impetus given by the method of induction through the influence of the preëminent Bacon.[7] Modern science has been the application of experimental proofs or demonstrations rather than continuous references to classical

[7] Bacon, Francis. *Novum organum.* London, 1620.

authors who may have been wrong in the first place; that is, the replacement of authority by experimentation.

More recent advances, however, have demonstrated (i) plastid inheritance in plants which is obviously cytoplasmic in nature, (ii) the placental transmission of maternal hormones and other entities, such as the production of witch's milk' with a stimulated mammary gland in the newborn, (iii) the transmission of viruses, antibodies, etc. in the mother's milk, and (iv) the effects of parental age on the characteristics of the offspring. All four of these biological processes affect the offspring and they all appear to be non-genic in nature. Whether they can permanently change the characteristics of the species remains to be proven. That the effects of parental age are cumulative and reversible, such as longevity in cladoera,[8] suggests perhaps one function of the gene may be a stabilizing influence toward keeping the species constant, and new, permanent changes may only be brought about by mutations. But plasmagenes and viruses can mutate also.

The introduction of the milk agent into a mouse may have either a temporary or permanent effect upon the incidence of adenocarcinoma of the mammary gland—depending upon the genetic constitution of the individuals in a given population. For example, the milk agent introduced into a $C_{57}$ mouse (cancer resistant) is incapable of increasing itself. It will be transferred through the milk into the young but will disappear after a few generations. On the other hand, the introduction of the milk agent into a $C_3H$ mouse (cancer susceptible but previously freed of the agent) will bring about, as far as known, a permanent change in the appearance of adenocarcinoma of the mammary gland; at least the neoplasm will continue to appear in mice through many generations. Here we have an intimate association between a gene (genetic constitution) and the activity of an extrinsic agent.

In the analysis of exceptional cases of heredity, such as the four classes cited above, extreme caution should still be used. Such a case in point is the inheritance of "poky" in Neurospora. According to the authors Mitchell and Mitchell[9] (1952), this "suggests the possibility that something is being transmitted through the cytoplasm. However, with so little information available as to

[8] Lansing, A. I. A transmissible cumulative and reversible factor in aging. *J. Geront.*, 1947, *2*, 228-239.

[9] Mitchell, M. B. and Mitchell, Herschel K. A case of "maternal" inheritance in Neurospora crassa. *Proc. nat. Acad. Sci.*, 1952, *38*, 442-449.

the possible nature of the defect, conclusions regarding the mechanism of its transmission would necessarily be highly speculative in nature." Perhaps this degree of caution should be applied to other biological observations which appear on the surface to be exceptions to classical genetic interpretations by gene action. It would seem, however, that the problem of transmission of characteristics or agents that determine characteristics of the offspring from one generation to the next is far from being solved.

Ideas in science as well as in other branches of human knowledge are old, stemming in many cases from ancient times. The observations upon which the ideas were based were, as at present, sometimes good and sometimes faulty. The observations may have been valid, but the conclusions wrongly colored by the philosophical system then in vogue.

A wet-nurse or the mother can influence the child through the milk—not perhaps in the old manner discussed by Burton, but by the transmission of particulate bodies such as viruses, antibodies, hormones, and probably other agents.