Where do babies come from?

William Harvey spent a lifetime searching for the earliest moments of life.

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William Harvey (1578–1657) was one of the most distinguished physicians and scientists of the seventeenth century. He was trained by the great anatomist Fabricius in Padua, and, on returning to England, eventually became physician to King Charles I. He was to achieve international acclaim when, in 1628, he published the slim volume *De Motu Cordis et Sanguinis in Animalibus* (On the motion of the heart and the blood in animals). This was the first accurate description of the circulation of the blood, based on acute clinical observations and experiments on live animals.

But Harvey's lifelong obsession was with the far more mysterious subject of reproduction. How was life transmitted from generation to generation? How was it conceived?

Harvey was an Aristotelian at heart, and Aristotle had a 'seed and soil' concept of reproduction, believing that the male provided the seed, which united with the menstrual blood to form an egg. Thus the egg was a product of conception, not something produced by the ovary.

Harvey used an experiment of nature to test Aristotle's views. He chose to study the generation of deer, which are strict seasonal breeders. His patron, King Charles, hunted deer once a week in his royal forests, parks and chases, and was fascinated by Harvey's studies of generation.

During the rutting season, which starts in late September for red deer and early October for fallow deer, the stags and bucks, with hard-horn antlers and passions inflamed by high levels of testosterone, become too dangerous for the huntsman to dispatch with a thrust of his sword. In Harvey's own words: "Their lust enrages them so, that they will assault or Doggs or Men, when at other times they are shie and timorous, and suffer themselves to be chased and put to flight upon the alarme of the least barking curre that is." So, from September to December, the quarry switched to hind and doe, and Harvey could search for Aristotle's eggs in the lumen of the uterus. Imagine his confusion, therefore, when he could not find any product of conception until early November.

This forced him to conclude that "the foetus doth neither proceed from the seed of male and female emitted in coition, nor yet from any commixture of that seed, (as the Physitians will have it) nor yet out of the Menstruous blood, as Aristotle conceits; and likewise that there is not any thing of the conception necessarily in being, presently after coition. It is also evident, that all females, in the act of coition, do not essund a seed into the uterus."

What Harvey failed to appreciate was that although the stags begin to rut in late September, this precedes mating and ovulation by 2–3 weeks. Furthermore, without the aid of a yet-to-be-invented microscope, he would have been unable to see the 0.1-mm-diameter fertilized egg until it had started to elongate, about ten days after fertilization.

And so he was left with a riddle: "Since I plainly see that nothing at all doth remaine in the uterus after coition, whereunto I might ascribe the principle of generation; no more than remaines in the braine after sensation, and experience, whereunto the principle of Art may be reduced; but finding the constitution to be alike in both, I have invented this Fable. Let the learned and ingenious flock of men consider of it; let the supercilious reject it: and for the scoffing ticklish generation, let them laugh their swinge. Because, I say, there is no sensible thing to be found in the uterus, after coition; and yet there is a necessity, that something should be there, which may render the female fruitful."

No doubt it was this bafflement that made Harvey reluctant to publish his findings. After much persuasion, he eventually relented, and *De Generatione Animalium* (On the generation of animals) was published in 1651. By then, Harvey was 73 and nearing the end of his days. Ironically, he chose for the frontispiece a drawing of Zeus holding an Aristotelian egg — from which plant and animal life bursts forth — inscribed with the prophetic words "*Ex ovo omnia*" (Everything comes from an egg).

Harvey would no doubt be mystified by our disapproval of those animal experiments that had enabled him to discover the circulation of the blood, and our condemnation of the hunting of deer with hounds. But a wry smile might have crossed his lips when he read in *Nature* of the cloning of Dolly the sheep, showing that something in the cytoplasm of the enucleated, unfertilized egg has the ability to restore totipotency to a differentiated somatic cell nucleus. He would also be pleased to hear that it is the egg that transmits mitochondrial DNA from generation to generation, and that it is these maternally derived mitochondria that even control the motility and hence the fertility of the male's sperm. *Ex ovo omnia* indeed! ■

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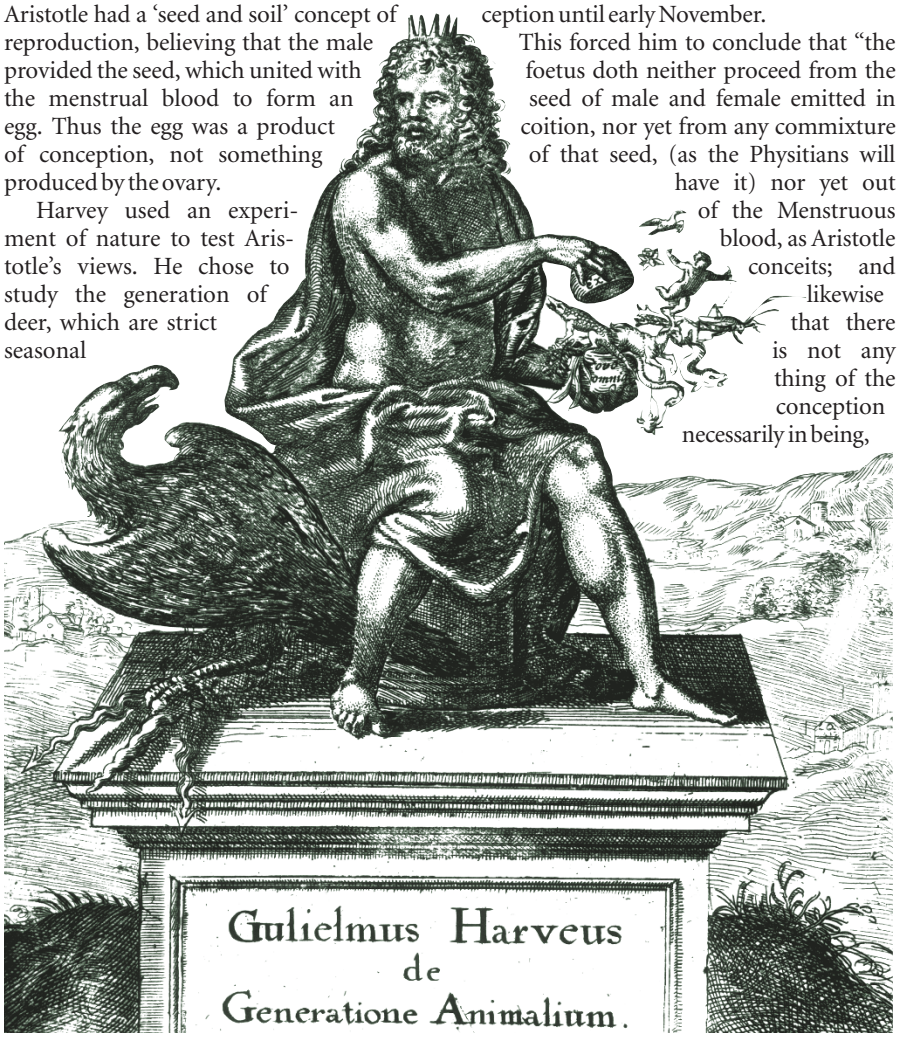

Divine rite: Zeus brandishes the all-powerful egg in Harvey's *De Generatione Animalium*.