

'Healthy' human embryos

A visual dialogue on 'healthy' human embryos from the sixteenth to the twenty-first centuries

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What can an art historian contribute to current debates about embryos? As a specialist of seventeenth-century French visual culture, I normally analyse paintings, sculptures and engraved prints. Though these prints sometimes feature medical images of the unborn, they rarely show what we would now call a human embryo. Throughout the early modern period (roughly 1450–1750) human embryos remained hypothetical entities that could be imagined but not definitely known (please refer to Maienschein and Robert, Chapter 1). In contrast, modern scientists, bioethicists, lawyers, philosophers, physicians and sociologists approach the human embryo as a knowable – albeit a mysterious – entity. This modern embryo, whether it is created inside or outside of the maternal body, has a material presence: it can be represented, measured, dissected, tested, manipulated, frozen, implanted or given away. Contemporary discussions about the human embryo tend to focus on whether it should be treated as a potential human life, a form of private property or a research tool. Many scholars highlight the ethical considerations raised by technologies involving embryos: how can couples undergoing in vitro fertilization (IVF) make truly informed decisions when asked to donate their 'spare' embryos to research scientists? Should the preimplantation genetic diagnosis (PGD) of these embryos be permitted? Is somatic cell nuclear transfer (more commonly known as cloning) an appropriate way to create embryos for research as opposed to reproductive purposes? A number of chapters in this volume address precisely these kinds of questions.

As an art historian wishing to participate in this dialogue, I have several options. I can select one question and insist that it cannot be fully answered without input from someone trained in the history of visual images. According to sociologist John H. Evans, debates about biotechnology are often staged as competitions between professionals, with experts asserting that their particular style of argumentation is the most legitimate (2002, p. 6). He claims that the discussions about human genetic engineering begun in the United States during the 1950s became 'thinner' and more superficial over time. Invoking anthropologist Clifford Geertz's concept of 'thick description', Evans calls for an interpretation attuned to the contexts and practices within which social meaning is produced (Geertz, 1973, pp. 3–30). Evans contends that by the 1990s, bioethicists, philosophers and policy-makers had instead focused narrowly on how genetic engineering would or would not serve the ends of individual autonomy, beneficence, non-maleficence and justice. Those concerned with other issues were labelled irrational unless they conformed to the dominant discourses and argumentation styles (pp. 16, 27). Ultimately the voices of the public and those of most theologians were excluded from serious consideration. If Evans's historical account is correct,

then any attempt by me or another art historian to claim jurisdiction over an established question relating to the modern or 'healthy' embryo would not enrich the discussion. This approach might add an interesting visual dimension to the debate, but would not challenge existing structures of knowledge and authority.

Alternatively, as an art historian, I could draw on my particular visual training to suggest questions that might not have caught the attention of those fully engaged in current deliberations about the healthy embryo. This method would eschew the usual strategies for claiming authority, such as refuting the arguments made by another scholar, or defending a novel thesis from premises to conclusions, using as evidence examples and counter-examples. Instead, as an art historian, I would take seriously my position as outsider to the complex scholarly discussions concerning the embryo, while recognizing that this outsider status carries its own kind of authority and perhaps even a romantic hint of rebellion. Nevertheless contributions from that position could form part of Evans's call for a thicker debate about biotechnology and might even allow greater participation in that debate from various members of the public.

In this chapter, I adopt this second approach by both engaging in and addressing forms of visual experiment. I begin by juxtaposing a typical image of an unborn human figure from the early modern period with a representation of the human embryo that circulates today. Placing these images side by side, I consider how they are alike and dissimilar, thereby initiating a dialogue between them. This comparative technique was developed during the early twentieth century by the Swiss art critic Heinrich Wölfflin (1915). He was principally concerned with the stylistic differences between Renaissance and seventeenth-century paintings, but art historians have since extended his method to assess changes in historical context, intended audience, the depiction of women, and many other issues.

When offering my course on Italian Renaissance art, I encourage students to examine images in relation to other images by projecting two slides on the screen and announcing 'This is the question.' My primary goal is to teach students how to perform the kind of informed looking crucial to the discipline of art history. This method recognizes that although visual perception might seem to be a strictly natural process, it is in fact a historically and culturally learned activity (Foster, 1988; Crary, 1990; Jay, 1993; McTavish, 2006). Anthropologist Sarah Franklin makes a similar point by drawing attention to the skilled looking enacted by modern scientists. She describes how she struggled to identify the nuclei in micromanipulated embryonic cells, and succeeded only by following the verbal instructions of embryologist Dr Sue Pickering (Franklin, 2003, pp. 77–80). Along similar lines, my written comparison of an early modern engraving and a modern image of the human embryo addresses the kind of looking that each representation entails, while encouraging readers to see the representations in new ways.

In the second section of this chapter, I consider visual experiments undertaken by other scholars, namely those artists active in the area of production known as 'bioart', sometimes called biotech art (Poissant and Daubner, 2005; Kac, 2007). When defined broadly, bioart refers to artistic work that engages with biology across various media, including written texts and digital images (Anker and Nelkin, 2004). A number of art critics affirm, however, that bioart more accurately describes work involving living organisms, such as plants, animals, bacteria and tissue culture (Vita-More, 2007, pp. 173–4). To address both kinds of bioart, this section analyses the work of Australian artist Patricia Piccinini, primarily consisting of silicone and acrylic sculptures that portray various forms of genetic manipulation. I also investigate work that eschews traditional artistic methods by using

living tissue as a material, focusing on the research of Canadians Shawn Bailey and Jennifer Willet. These bioartists sometimes parody the official discourse of biotechnology and at other times work in conjunction with scientists. Their results can undermine distinctions between artistic and scientific practice, revealing that scientific research is often embodied, accidental and passionate, despite the pervasive representation of science as rational, cool and calculating. I contend that bioart not only offers new ways of thinking about the questions usually posed in relation to embryos, especially with regard to ethics, but also moves beyond these perspectives to invite diverse audiences to reconsider the impact of biotechnology on society and their everyday lives.

Regarding the human embryo

Fourteen engraved images of the unborn enrich *La Pratique des accouchemens* [The practice of childbirth], an obstetrical treatise published in 1694 by French surgeon man-midwife Philippe Peü. All the images depict playful toddlers in contorted postures floating inside spacious egg-shaped wombs (Fig. 8.1). These miniature humans are clearly at risk of strangulation, and one even pulls at the umbilical cord wrapped around its neck. At the same time, references to danger are belied by the blissful expressions on their faces. The engravings in Peü's treatise are remarkably beautiful, but they are not unique. Representations of child-like figures in perilous situations routinely appear in obstetrical treatises

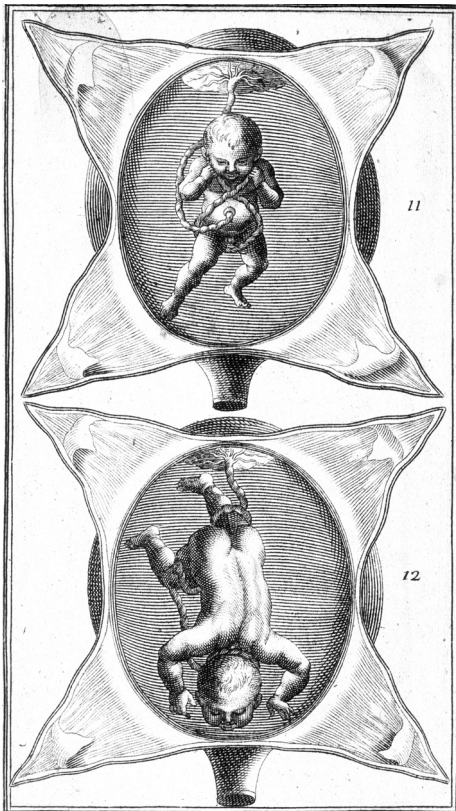


Fig. 8.1. Unborn figures, from Philippe Peü's *La Pratique des accouchemens* (Paris, 1694). (Courtesy of the Edward G. Miner Library, University of Rochester Medical Center, Rochester, NY.)

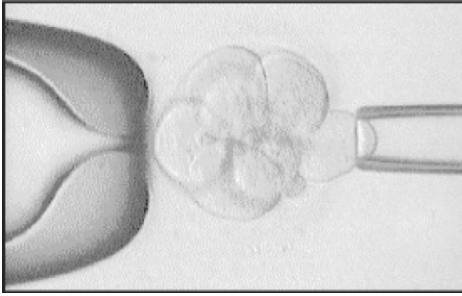


Fig. 8.2. Embryo undergoing biopsy for the purpose of preimplantation genetic diagnosis (PGD). (Courtesy of Dr Joyce Harper.)

published in Europe between 1550 and 1750 (McTavish, 2005). Sometimes the normal birth position is pictured, and the unborn figure's limbs are drawn in to its torso. Such representations provide, however, a point of contrast for the unnatural positions that prevail in the treatises. Unborn figures are usually shown at risk: appendages flung in all directions, one hand extending towards the mouth of the womb, in a breech position with arms raised overhead, or with feet and hands presenting together.

Peu's engraving of endangered unborn figures would seem to have little in common with the modern photograph of an early 'at-risk' human embryo in the process of having one cell removed for PGD testing (Fig. 8.2). This image portrays a blastomere biopsy; the transparent embryo attached by suction to a holding pipette on the left while a single cell is aspirated into a hollow micropipette on the right. Whereas the early modern engraving was produced by the hand of an anonymous commissioned artist, this image was created with various technologies, including the fluorescence microscopy that magnified the embryo, controlled the light necessary to see it and then directed the results for capture by a photographic medium (Cox, 2007). The resultant flattened image features clean sharp lines, conveying a certain coldness and precision. In contrast, the early modern engraving is more sensually appealing with its rich texture, finely modelled unborn figures and meticulously rendered placentas.

The most notable difference between the two images, however, is their subject matter. Peu's engraving does not portray embryos; it displays fully formed fetuses that look more like children than what we could expect to find in the womb. Embryology was indeed practised during the early modern period, with scholars generally adhering to either epigenetic or preformationist theories, yet the imaginative ideas of early modern embryologists had remarkably little impact on obstetrical treatises, the type of publication that included engravings like Peu's (Dunstan, 1990; Pinto-Correia, 1997; Roger, 1997; Hopwood, 2002). The authors of these books, mostly French and mostly surgeons, defended well into the eighteenth century the Galenic theory of conception as resulting from the mixture of male and female seed (McTavish, 2005, pp. 203–6). In 1573, barber–surgeon Ambroise Paré explained how the male and female seed actively combined and fermented in the womb. First, three bubbles formed the rudimentary beginnings of the organs, and then the bones and interconnecting channels were covered with a protective skin (Paré, 1573, pp. 37–48). Paré was nevertheless unusual in the attention he paid to early stages of development. Most authors of obstetrical treatises did not describe the contents of women's bodies during the initial stages of pregnancy, offering practical advice about the signs of pregnancy, difficult labours and postpartum complaints to an audience consisting of male medical

practitioners, female midwives, pregnant women, lay people and even readers in search of a sex manual (Erickson, 1982).

During the early modern period medical practitioners were cautious about identifying what might be found inside the female body. In 1609, the French royal surgeon Jacques Guillemeau explained that he would look ridiculous if after having assured a woman that she was pregnant, her womb produced only menses, water or noisy winds (p. 2). As late as the eighteenth century, surgeon Guillaume Mauquest de La Motte insisted that pregnancy could not be verified until the fourth month because until that date the contents of the uterus were minuscule and although the womb might harbour a fetus, it might just as likely contain a mass of unformed flesh called a mole, or water, wind, and retained menses (1729, p. 49). According to historian Barbara Duden, pregnancy was confirmed exclusively by women during the early modern period, when they felt 'quickening' or movement inside their bodies (1991, pp. 158–61). She argues that the human embryo was not actually invented until 1799 when Frankfurt physician and anatomist Samuel Thomas Soemmerring published drawings of a series of male and female embryos and fetuses, lined up by age and size, in his *Icones embryonum humanorum* [Images of human embryos] (Duden, 1999). Wanting to exclude the subjective human eye, Soemmerring instructed his artist to produce a measured elevation of each embryo by drawing it as if seen from a series of right angles at an infinite distance. Duden contends that because Soemmerring's resulting plates portrayed virtual embryos in a way that no eye could ever really see them, the human embryo appeared as a fact and an object for the first time in history (Fig. 8.3).

The modern photograph of an embryo undergoing a biopsy adheres to the principles outlined by Soemmerring, employing complex technologies to depict an embryo that the naked eye could never see, apparently removing subjective human perception from the imaging process. The resulting representation seems simply to provide an accurate image of the embryo in the laboratory. This image can function as a 'fact' because it is assumed to be indexical, referring to the semiotic definition of index as a type of visual sign dependent on a real contiguity between the image and the object it portrays. American semiotician Charles Sanders Peirce explains the index by describing a piece of mould marked by a bullet-hole: 'without the shot there would have been no hole; but there is a hole there, whether anybody has the sense to attribute it to a shot or not' (1991, pp. 239–40). Fingerprints and footprints are other examples of indexical signs because they depend on the material presence of the original object and provide evidence of that object even if they do not resemble it in an obvious way. In contemporary western culture, photographs are often assumed to be indexical in this manner, providing inscriptions of the real world, as if material objects had literally touched or been physically imprinted on the film. Art historian Joel Snyder (2004) points out that photographs were historically considered unreliable, and not accepted as evidence in American courtrooms until the 1880s. Despite numerous efforts by scholars to challenge the truth value of the photographic medium, many still commonly assume that photographs unaltered by technologies such as Photoshop can be taken at face value.

The image in Peu's obstetrical treatise is not indexical. In fact, Peu insisted that the visual contents of his engravings had little connection with the actual contents of women's bodies. No early modern surgeon argued that unborn figures resembled fully formed children performing acrobatics inside gigantic wombs. On the contrary, they wrote about the cramped quarters of fetuses, noting that the unborn figure in the womb was 'curled and bent like a round ball' (Arons, 1994, p. 3). At least one surgeon asserted that standardized

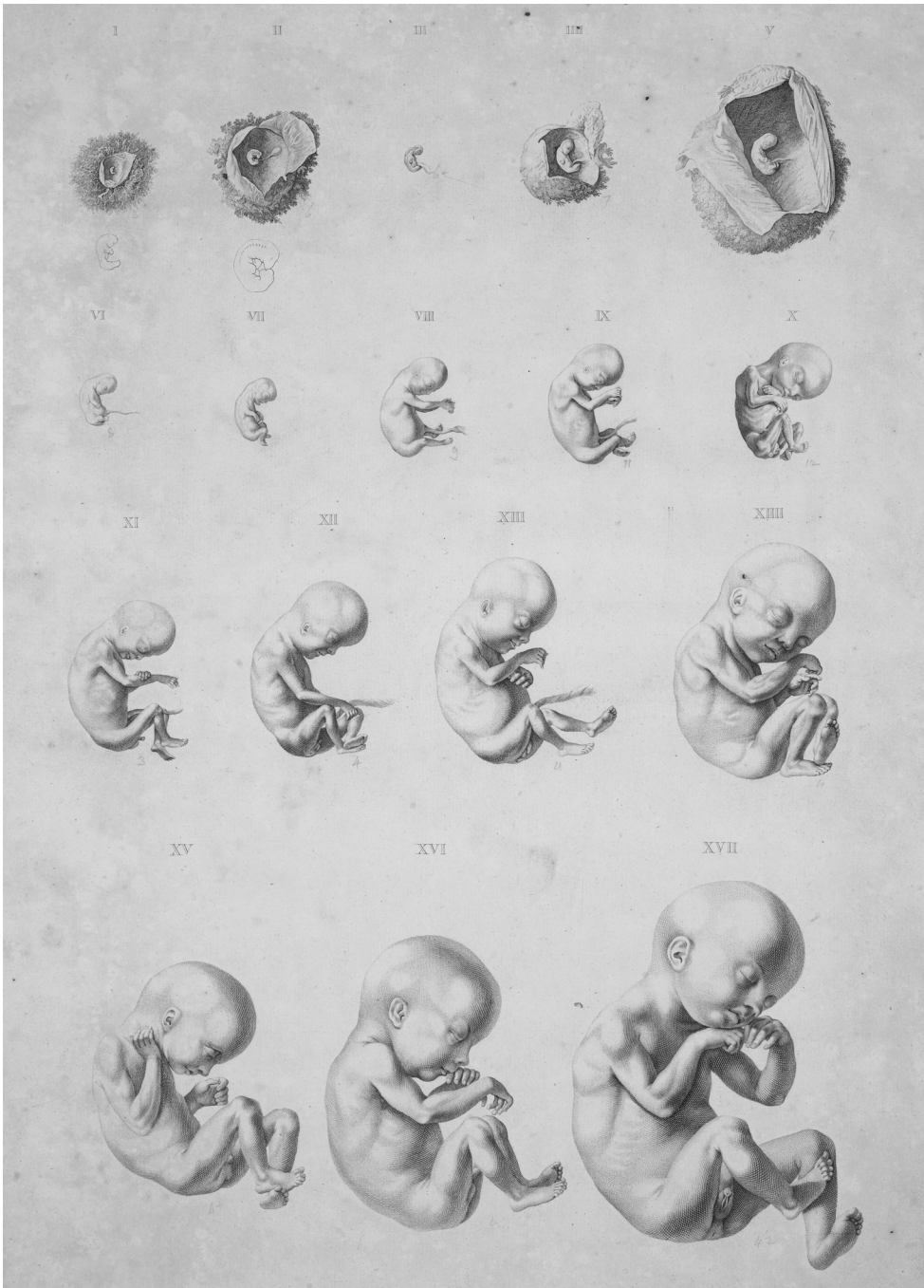


Fig. 8.3. Engraving by the Klaubers, after drawings by Christian Koeck, from Samuel Thomas Soemmerring's *Icones embryonum humanorum* (Frankfurt am Main, 1799). (By permission of the Syndics of Cambridge University Library.)

images, such as the ones in Peu's book, were therefore 'useless', and all agreed that the interior of the female body was essentially a dark, mysterious realm eluding the human eye (Dionis, 1718, pp. xj–xij). French surgeon men-midwives nevertheless proclaimed that the female body could be discovered by their perceptive hands, which acted as substitutes for their eyes. When recounting their work in the lying-in room, the men described performing manual examinations to 'discover' the state of labour, 'look for' the distressed child and 'observe' its posture (Portal, 1685, pp. 2, 79; Peu, 1694, p. 408; Mauquest de La Motte, 1746, p. 359). Peu provided detailed guidelines encouraging surgeons to distinguish between the different parts of the child by means of touch alone: for example, the head could be recognized by its round, hard skull: the eyes by their number, the cavity of their sockets, elevation of the eyeballs (1694, pp. 51–54). Clearly, an image of the unborn child emerged from the physical manipulation of the womb, not from any direct visual access.

Why, then, were images of the unborn commonly included in early modern obstetrical treatises? What was their purpose? Peu provided an exceptionally detailed account of the engravings in his own publication. He argued that although his plates depicted only some of the situations in which he had found children 'reduced' by twisted umbilical cords, they 'could serve as a principle idea for conceptualizing an infinity of other possible [situations]' (1694, p. 441). Peu described the images as diagrams, typically associated with the expression of scientific ideas. By distilling the scientist's observations into a simple formula, diagrams provide a principle that can be tested in subsequent research. According to Peirce, diagrams are iconic signs, based on resemblance between the sign and the object portrayed, yet they 'resemble their objects not at all in looks; it is only in respect to the relations of their parts that their likeness consists' (1931–5, p. 157). Diagrams support creative thinking because they can be observed and contemplated to discover unnoticed relations amongst the parts of the object portrayed. Peirce's description of diagrams is in keeping with Peu's account of his images of the unborn as ideas enabling male midwives to imagine malpresentations they had not previously encountered. According to Peu, the early modern engraving is a conceptual tool enabling thought, not an inscription of reality.

This comparison between an early modern engraving and a modern photograph highlights the vast and perhaps insurmountable differences between them. The images diverge in terms of their aesthetics, modes of production, subject matter and the ways in which they communicate meaning. This comparison risks reinforcing the commonsense notion that current scientific knowledge has progressed well beyond the muddled ideas of the past. Peu's understanding of the images in his obstetrical treatise was, however, very sophisticated. He described them as useful reference points allowing medical practitioners to make sense of the unknown. Though art historians and other scholars have long argued that the visual realm actively creates meaning, this realm is often denigrated in contemporary western culture, associated with 'mindless entertainment' in discussions of popular culture, or assumed merely to offer a passive reflection of knowledge in certain scholarly practices, including some scientific ones (Debord, 1970; Adorno and Horkheimer, 1993; Stafford, 1994).

Despite these important differences, the two images have much in common. They both depend, for example, on the absence of the female body, most notable in the modern photograph of the embryo, which focuses on cells not on the portrayal of human bodies. The composition of the image places the embryo in the centre, separating it from the physicality of the outside world. This detachment enables the embryo to become a thing in and of itself, worthy of visual scrutiny. Various scholars have argued that the perceived

relationship between the human embryo and the maternal body is crucial to current discussions of human embryonic stem cell research and reproductive technologies. In her discussion of the American legal system, law professor Radhika Rao points out that an embryo located within a woman's body is characterized as part of her body, forestalling protectionist legislation that would infringe on her right to bodily autonomy and sex equality (please refer to Rao, Chapter 3). Once that embryo is separated from the maternal body, however, 'others', including government agencies, can formulate policies designed to manage or protect it. The status of human embryos thus changes according to their context, a claim made more broadly by Sarah Franklin, who describes them as a 'vast and diverse population, imaged, imagined and archived in media as diverse as liquid nitrogen, DVDs, virtual libraries, t-shirts, logos and brandnames' (Fausto-Sterling, 2003; Franklin, 2006a, p. 168).

The detachment and subsequent mobility of the embryo contributes to the embryo-centric nature of current debates about its rights and identity. According to bioethicist Jackie Leach Scully and colleagues, this focus marginalizes those who supply the reproductive material (gametes) needed to create human embryos, including couples asked to donate their 'spare' IVF embryos (see Scully, Rehmann-Sutter and Porz, Chapter 2). Also regularly forgotten in debates about stem cells are women who undergo hormone injections and surgical procedures to supply eggs for various kinds of research (Stoyle, 2005; Dickenson, 2006). Jeff Nisker and Roxanne Mykitiuk contend that many altruistic egg donations occur within coercive conditions, settings often shaped by the hierarchy of the doctor-patient relationship (please refer to Mykitiuk and Nisker Chapter 9). This potential for coerced donations was recently highlighted in the scandal involving South Korean biomedical scientist Woo-Suk Hwang, who claimed to have created human embryonic stem cells by cloning (Hwang, 2004; Hwang, Roh, Lee *et al.*, 2005). After the journal *Science* retracted his original article because it was based on fabricated data, Dr Hwang admitted that two of his graduate students had donated their eggs for his research (Holden, 2005; Kennedy, 2006). Hundreds of Korean women subsequently agreed to provide eggs without compensation, an overt indication of their support for Dr Hwang but also perhaps an implicit assertion of their ability to make informed decisions (Holden, 2005). In any case, women made a brief appearance in the public debate about stem cell research.

Although no sign of the female body is evident in the photograph of the biopsied embryo, references to women's bodies remain in the early modern engravings found in obstetrical treatises. Commonly, the maternal body appears in the fragmented forms of dissected wombs, umbilical cords and placentas. The female body rarely appears in its entirety. The book published by English midwife Jane Sharp in 1671 shows an engraving of a pregnant woman as a plant producing fruit; the healthy child is both dependent on and created by her fertile maternal body (Fig. 8.4). Peau's more typical engraving is vastly different, depicting badly positioned, unhealthy fetuses in need of medical intervention. This emphasis on endangered unborn figures corresponds with the efforts made by male midwives to expand their practices within the birthing room. Authoritative female midwives controlled childbirth throughout the early modern period, and men were summoned primarily in cases of emergency, to remove impacted fetuses from the womb using hooks or head pullers. Struggling to portray themselves as skilled birthing assistants, male midwives claimed that they could legitimately enter the lying-in room in difficult cases when the 'natural' efforts of both the maternal body and the female midwife had failed (McTavish, 2005, pp. 199–201). French surgeons drew attention to their skilled hands which could 'see'

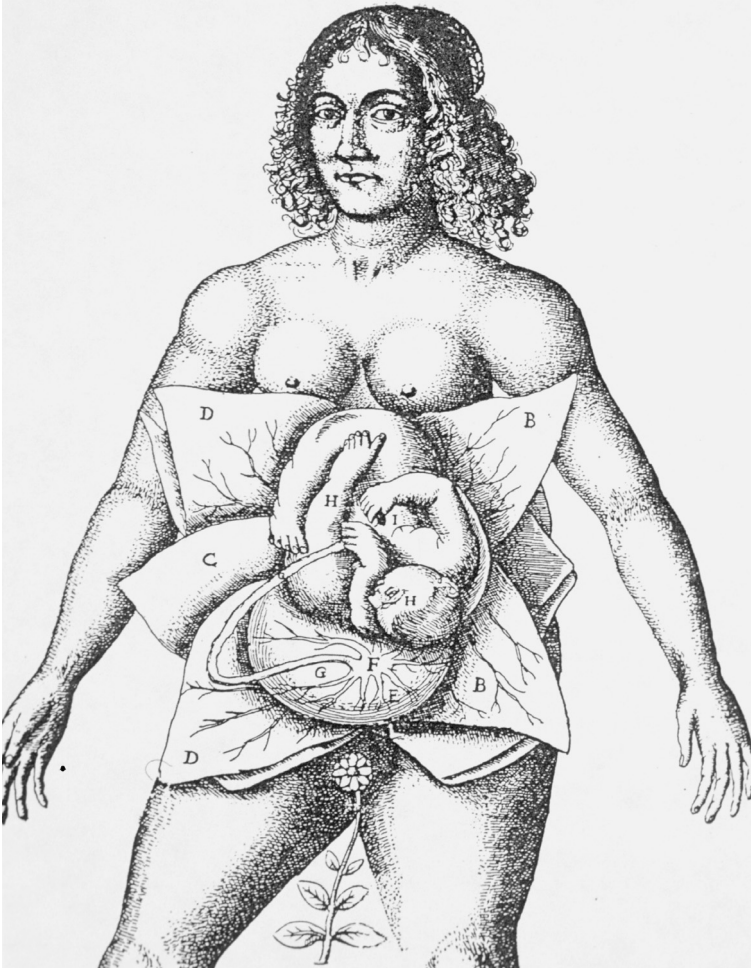


Fig. 8.4. Fertile woman, from Jane Sharp's *The Compleat Midwife's Companion* (London, 1724). (Courtesy of the Wellcome Library, London.)

the unborn figure and turn it in the womb for a podalic (feet-first) delivery, a method they claimed surpassed the abilities of the average female midwife. The reduction of the pregnant woman to a womb in *Peu's* engraving thus creates an operative space for the entry of this medical expert. Though the surgeon's presence is merely implied as necessary, it is concretely represented in other early modern obstetrical engravings. The plates in French man-midwife *Cosme Viardel's* treatise of 1671, for example, depict male hands entering the womb to manoeuvre malpositioned children (Fig. 8.5).

Manipulating hands are equally implied in the modern photograph, which shows an embryo framed by two micropipettes. Referring to a similar image, *Franklin* designates them the 'two helping hands' of science (2005, p. 66). Whereas in *Viardel's* engraving, the male hand operates on the principle of synecdoche to represent the whole surgeon, in the modern photograph the technological tools invoke a more abstract entity: 'science'. In both cases, however, the hands are shown intervening to alter the unborn entity. Unlike the bare hands of the French surgeon, the tools that remove one cell from the embryo to test for

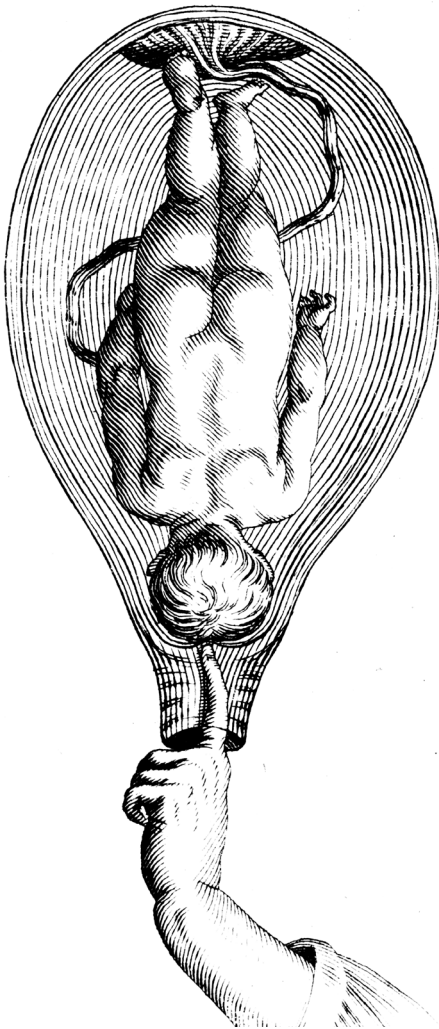


Fig. 8.5. Unborn figure from Cosme Viardel's *Observations sur la pratique des accouchements naturels, contre nature et monstrueux* (Paris, 1673). (Courtesy of the National Library of Medicine, Bethesda, MD.)

genetic abnormalities are antiseptic and fleshless. The embodied subjectivity of the scientist or medical practitioner holding the tools is bracketed out of the image. This denial of embodiment accords with arguments made by sociologists such as Bruno Latour and Steve Woolgar (1986) and Steven Shapin (1999). Their ethnographic and historical studies reveal that for the final results to be accepted as scientific facts, the researcher needs to make invisible the messiness of laboratory life – its inconclusive data, mistakes and accidents.

Though the photographic image reinforces an official representation of 'science', it does not necessarily correspond with scientists themselves and how they characterize their own research. Scientists especially adept at manoeuvring minute, delicate cells are said to have 'good hands', a description recognizing their skill as embodied. Franklin explains that Dr Pickering is credited with possessing 'green fingers' because she seems particularly able to grow stem cells (2006b, p. 79). This appellation refers not only to her body but also to her

nurturing and even maternal qualities, as she seeds cells into the feeder beds. The subjectivity of scientists is foregrounded when they grade embryos during the IVF process, deciding which ones are 'good looking' and thus ideal for transfer to the womb. Good embryos are robust, displaying clear, even, well-rounded development, whereas 'poor looking' embryos are uneven, opaque, and slow to divide (Franklin, 2006c, pp. 145, 151). Embryologists are quick to admit, however, that the visual evaluation of an embryo's morphology may not provide reliable information; embryos that 'look like crap' but are implanted as a last resort can turn out to be viable (Franklin, 2006b, p. 82).

To this point, I have discussed both the engraving and the photograph in relation to their immediate contexts, namely the politics of early modern childbirth and the modern laboratories where human embryos and human embryonic stem cells are manipulated. What happens when these images are removed from these contexts and made to signify differently? In a sense, I have already performed such a decontextualization by separating each image from the series of which it was originally a part. In *Peu's* obstetrical treatise, the engraving was positioned alongside 13 similar plates of malpresenting fetuses, combining with them to portray childbirth as an overwhelmingly dangerous activity. The modern photograph of the embryo was likewise originally displayed within a sequence of images showing the entire biopsy procedure; it followed a depiction of a micro-needle opening the zona pellucida of the embryo to enable the subsequent cell removal (Verlinsky and Kuliev, 2000). By selecting and juxtaposing the two images, I have created new meanings for both, a stated part of my goals in this chapter.

Art historians argue that visual images refer to other images more than to the external world (Panofsky, 1962; Bal and Bryson, 1991). According to the theory of intertextuality, all texts depend on a host of conventions, codes and other texts for their existence. Any written text or visual image therefore contains an unavoidable multiplicity of references, with signifiers referring to other signifiers and meaning constantly deferred (Kristeva, 1980; Derrida, 1986; Allen, 2000). Thus, *Peu's* early modern image looks different to modern viewers from how it looked to early modern viewers. It is now a relatively 'open' text because of its superficial resemblance to modern fetal imagery, especially the depictions promoted by those opposed to legal abortion. Drawing on these visual similarities, literary critic Karen Newman (1996) argues that the fetus has long been visualized as an inviolable, rights-bearing individual. Though the early modern fetus was never understood in this modern way, Newman's observations may seem correct because *Peu's* engraving shows well-developed unborn figures detached from the maternal body, recalling Lennart Nilsson's photographs of embryos and fetuses shown floating against celestial backgrounds, produced for *Life* magazine in 1965. According to anti-abortionists, Nilsson's images provide irrefutable evidence of 'life' in the womb, although many of the specimens he photographed had been surgically removed from the womb and were in fact dead (Stabile, 1993). Despite the efforts of anti-abortionists to insist that such fetal imagery has only one obvious meaning, the representations regularly appear in popular culture, in advertisements for movies and cars (Mink, 1985; Taylor, 1992; Duden, 1994; Kaplan, 1994).

The modern photograph of an embryo might seem, however, to be less open to such multiple meanings and popular appropriations (Fiske, 1989). In 2000, scholars Clare Williams, Jenny Kitzinger and Lesley Henderson undertook a quantitative study of the media in the United Kingdom to discover how scientific images of embryos were being used. They found that anti-abortionists and others opposed to human embryonic stem cell research did not deploy photographs of early embryos as part of their political strategies.

The representations were instead reproduced by proponents of human embryonic stem cell research because ‘the pre-14-day embryo looks nothing like its 12-week-old counterpart used by anti-abortionists to display perfectly formed fingers and toes’ (Williams, Kitzinger and Henderson, 2003, p. 801). This observation indicates that relatively new images of embryos are interpreted in relation to well-known fetal imagery. According to the authors, multi-celled embryos resemble alien blobs more than human beings, an understanding encouraged when the photographs are reproduced in colour to show the saturated hues of the stains applied by scientists to make the parts of the embryo more visibly distinct (Verlinsky and Kuliev, 2000). These examples suggest that modern depictions of embryos are indeed read intertextually and can convey numerous meanings, as suggested by Franklin in her account of the discursive nature of embryos (Franklin, 2006a).

Malleability is highlighted in the photograph of the blastomere biopsy, revealing what Maienschein and Robert call the ‘constructed’ embryo (please refer to Maienschein and Robert, Chapter 1). In this image the embryo itself is portrayed as an open text that can be rewritten, a possibility that excites researchers but frightens others, including some members of the public. Those whose world-view depends on beliefs in an immutable embryo imagine that the absent body holding the ‘helping hands of science’ belongs to a mad scientist bent on destroying vulnerable embryos. When images of early embryos leave the settings of the laboratory and the scientific journal, they are understood in relation to a wide range of sources, including science fiction literature and films, leading to interpretations varying according to the viewers’ particular cultural backgrounds, knowledge and life experiences (Hall, 1993). Efforts by scientists and other scholars to inform an ‘ignorant’ public about the true or singular meaning of these images will fail unless they acknowledge the complexity of visual communication and reception. Contemporary artists, however, are formulating alternative methods for engaging the public with biotechnology, both critically and visually.

Artistic interventions in biotechnology

The idea that scientific imagery and practice can be resignified is key to bioart, a long-standing practice whose origins are often located in the 1930s, when American photographer Edward Steichen employed genetic manipulations to create gigantic, hybrid delphiniums (Gedrim, 2007). Now, a range of contemporary artists both interact with and criticize biotechnology – by culturing bacteria, sculpting with proteins, fusing their white blood cells with mice myeloma or cloning walnut trees – sometimes from within its structures and sometimes from the outside (Kac, 2007). Though the resulting artistic works and performances may seem esoteric to those unaccustomed to the art world, they are largely meant to question the construction of expertise, allowing a broader public to have access to the founding concepts and practices of technoscience. Canadian bioartist Jennifer Willet acknowledges that although some of her work is available on the Internet, it still might not reach a mass audience. She hopes it will nevertheless have a ‘trickle down effect’ by encouraging increased discussion and debate about biotechnology in the long run (personal communication, 14 February 2008).

Instead of working with living tissue, renowned artist Patricia Piccinini uses modern materials, including silicon and acrylic resin, to create sculptural installations that explore the themes of genetic engineering and biotechnology. Her show *We Are Family* was featured in the Australian pavilion of the 2003 Venice Biennale – one of the world’s most important recurring exhibitions of contemporary art. Piccinini’s sculptures represent bizarre, hybrid creatures, complete with soft flesh and real human hair. Her 2002 *Still Life*

with *Stem Cells* portrays a life-sized young girl surrounded by corporeal lumps adorned with mouth-like openings (website reference). Although viewers may find the 'stem cell' blobs repulsive, the girl affectionately hugs one to her chest while resting her hand on another, treating it like a family pet. This sculptural group is in dialogue with the genre of science fiction, inviting viewers to fantasize about what might happen in the future if the human body becomes simply another kind of material to be manipulated (Michael, 2002; McTavish, 2003; Goriss-Hunter, 2004; Lauritzen, 2005). Yet Piccinini's creatures remain domesticated (at least for now), providing a vision of genetic modification that is neither utopian nor dystopian (Haraway, 2007).

By titling her installation 'still life', Piccinini places it within an art historical tradition. Like paintings of fruit and flowers that purport to show a slice of everyday life, Piccinini's work displays a banal scene from modern suburbia: a young child playing as if in a domestic interior. Any sense of normality, however, is countered by the undefined forms that act as her companions, existing somewhere between the human and non-human realms. The overall effect is uncanny, for the spectator confronts a scene that is simultaneously familiar and strange. This effect is conveyed to a large degree by the work's hyper-real details, which include hair follicles and wrinkled skin. According to art historian Norman Bryson (1981), the realist aesthetic functions by providing an excess of information, divorcing details from narrative goals and didactic lessons so that they seem unmotivated and thus true. This reality effect is enhanced by the tactility of Piccinini's work, which like the comparable sculptures of Duane Hanson and Ron Mueck, invites viewers to respond physically with a shiver of disgust and delight. The realism of the modern photograph of an early human embryo discussed above operates differently. Though also dependent on apparently neutral details to convey accuracy, it effaces signs of embodiment, distancing viewers from the image rather than inviting their identification with it. Piccinini's sculptural installation plays with the signifying systems used by science, reshaping them to convey other meanings.

Artists Shawn Bailey and Jennifer Willet consider a different form of scientific aesthetics by exploring the economic goals of biotechnology. Visitors to their virtual laboratory called BIOTEKNICA (www.bioteknica.org) are greeted by a professional logo before entering the website to find linear diagrams of molecules and photographs of specimen bottles. BIOTEKNICA's 'corporate history' identifies it as an international bioengineering firm that develops 'patent and copyright applications for several pre-fetal genome mutations, and post-fetal cellular processes, and related digital imaging technologies'. Such boastful and vague commentary is undermined by a subsequent description of BIOTEKNICA as a fiction designed in 2000 by Bailey and Willet to parody, and thus invite criticism of, typical forms of biotechnical self-presentation. BIOTEKNICA has nevertheless attracted investment offers, a development troubling to its creators because the corporate vision includes 'placing the power of genetic supremacy in the hands of humanity itself' (BIOTEKNICA).

In this work, Bailey and Willet engage with the increasing commodification of hybrid entities, DNA, cells, and human tissue. Scholars such as Margaret Lock (2001) and Catherine Waldby and Robert Mitchell (2006) have written arguments about the transformation of the gift economy that once structured exchanges of human tissue. Bioartists Bailey and Willet participate in this analysis, inviting viewers to do the same. BIOTEKNICA's virtual laboratory software allows visitors to create their own products, simulating the role of the scientist-entrepreneur. The site allows visitors to custom design digital images of teratoma – cancerous growths containing hair, skin and possibly stem cells – by mixing the ingredients and then 'breeding' them (www.bioteknica.org/index2.html). Whereas Piccinini's work elicits

visceral reactions from viewers and suggests ownership by having the little girl embrace and caress the stem cell blobs, BIOTEKNICA allows its audience to perform virtual experiments, combining different elements to create new forms of 'life'. According to the artists, BIOTEKNICA 'avoids prescriptive critical mantras', focusing instead on allowing viewers to formulate their own conclusions about the procedures and protocols presented (Willet and Bailey, 2007).

In 2004, Bailey and Willet moved beyond conventional forms of artistic creation and display to adopt a critical participatory methodology. They began to grow material teratoma tissue cultures at SymbioticA, the Art and Science Collaborative Research Laboratory at the University of Western Australia. With Oron Catts and Ionat Zurr from the Tissue Culture and Art Project, they cultivated cells of P19 mouse teratoma (Willet and Bailey, 2007). Teratomas fascinate the artists because they can be considered a natural type of cloning, genetically identical to humans (Winters, 2006). The ambiguous status of these tumours has long been compelling to medical practitioners, who during the early modern period considered them a monstrous form of reproduction, even when created outside of the womb. For example, in a medical journal from 1697, editor Claude Brunet reported that when surgeons amputated and then dissected the swollen testicle of a Cistercian monk, they removed a fleshy mass replete with bones and an afterbirth, proving that male pregnancy was possible (Brunet, 1697). The appeal of unnatural or monstrous reproduction has not diminished, as indicated by the popularity of Piccinini's stem cell blobs, sometimes categorized as a version of the 'monstrous cute' (Goriss-Hunter, 2004). Nothing, however, is cute about Bailey and Willet's examination of monstrosity, which produced what they call tissue culture sculptures, made by encouraging the mouse teratoma cells to attach to polymer scaffolds.

Modern responses to the diverse field of bioart depend on the work in question and the critic examining it. Art historians, like myself, are intrigued by the use of living tissue as an artistic material because it is relatively new and challenges traditional definitions of the artist even as it raises ethical implications by blurring distinctions between artistic and scientific research, an idea supported by bioethicist Arthur Caplan who supports the blending of art and science but argues that it is an ethical abuse to 'use genetics simply for artistic exhibitionism' (Allmendinger, 2001). Other commentators argue that bioart complies with biotechnology instead of opening it to question. According to American bioartist Adam Zaretsky (2005), 'some say that biology as an arts process is merely a promotional tool for big science'. Willet reports that this same perspective has been used at scholarly conferences to condemn the participatory work of herself and Bailey in scientific laboratories. Their various collaborations with biologists have been compared to embedded journalism, when news reporters experience armed conflict from the inside by travelling with the military. Critics contend that just as these journalists are constrained by regulations and ultimately come to identify with the military unit in which they are embedded, so too will bioartists become part of biotechnology, overwhelmed by its powerful allure (J. Willet, personal communication, 14 February 2008).

Nevertheless opportunities can be gained by working from the inside rather than as a perpetual outsider or layperson, the position embraced by Piccinini (Piccinini and Orgaz, 2007). Feminist scholar Evelyn Fox Keller has advocated transforming science from within, arguing that science is a distinctive practice with its own logical and empirical constraints (1992, pp. 2–3). As a trained physicist, Keller has critiqued the masculinist nature of dominant science, while considering the way in which language shapes scientific practices. Bioartists are unlikely, however, to be identified as scientists, even when they have been

professionally trained to grow tissue culture. Bailey and Willet, for example, are positioned on the margins of the laboratories in which they work, as outsiders temporarily welcomed inside. I contend that this intermediary status is nevertheless enabling, allowing bioartists both to examine and to attempt to perform the *habitus* promoted in particular scientific realms. French sociologist Pierre Bourdieu defines *habitus* as a system of dispositions or acquired modes of perception, belief, thought, and action (1984, p. 34). Dispositions vary according to the specific 'fields' in which they are developed. According to Bourdieu, a field 'is a space in which a game takes place, a field of objective relations between individuals or institutions who are competing for the same stake' (p. 197). Fields are social systems that function according to specific rules, and people engage on a daily basis with any number of them – the family, specific leisure activities, their profession. These social systems compete for legitimacy or symbolic capital by interacting with the often implicit rules of the game, which they learn through experience. Instead of being obligated to follow these rules, individuals are in constant negotiation with them (Moi, 1991). Within technoscience, legitimacy is acquired in some obvious ways: by attaining an education, placing publications in particular venues, attracting significant research funds, and creating deliverables that can be patented. Legitimacy is also achieved more tacitly, through proper bodily comportment, modes of speech, and patterns of thought. Bioartists can contemplate these embodied aspects of biotechnology by means of their physical and intellectual interactions within laboratories. At the same time, these artists may learn to reflect on the distinctive *habitus* of the art world, for they ultimately need to earn symbolic capital in that field if they hope to continue their artistic careers.

No doubt the interaction of artists with scientists encourages some sympathies between the two groups. Attending to the *habitus* promoted by particular laboratories foregrounds scientists as embodied individuals who are continually both constrained and produced by the rules of their field. These interactions distinguish actual scientists from the generalized entities known as 'biotechnology' and 'science', potentially resulting in more accurate understandings of both terms. My own limited experiences interacting with physicians, biologists and veterinarians at various collaborative conferences has had this effect, revealing the scientists as passionately devoted to their research. These cross-disciplinary discussions have also uncovered surprising links between the present and past. Modern scientists regularly spoke about their material engagement with and understanding of their research subjects, whether animal or oocyte, just as early modern medical practitioners earned authority primarily through their physical experiences with matter, gained through the sense of touch (McTavish, 2005, pp. 87–8, 154–63).

Some forms of bioart work both to break down and to highlight the distinctions between art and science, distinctions not yet constructed during the early modern period. Artists are able to position themselves in relation to science primarily because both fields privilege hands-on knowledge, originality, and creativity. Yet a number of artists have also found that adopting the role of artist–researcher or artist–scientist allows them to apply for financial support from agencies that have not traditionally recognized the value of the visual arts. Contemporary funding structures have therefore encouraged the emergence of the artist as researcher, providing both opportunities and potential restraints. Bailey and Willet describe, for example, the ethics approval they needed to obtain before undertaking work with human cell sources. They found it difficult to explain their artistic goals in the standardized terms of health benefits, outcomes, and deliverables. In the end, they considered the lengthy ethics procedure that continued from 2004 to 2005 a performance piece

in itself (www.biotechnica.org/index2.html). According to the artists, this process allowed them to engage fully with the methods of the scientific community. I contend that it also encouraged them to recognize the ‘rules of the game’ of a different field, which was initially foreign and uncomfortable.

Conclusions

This chapter has brought together apparently diverse things – an early modern print and a modern photograph, art and science – in order to consider both what is distinctive about each one and the sometimes surprising ways in which they overlap. My first question asked whether an early modern engraving of unborn figures and a modern microscopic visualization of a human embryo could speak to each other. Despite their differences, I showed that both representations featured a largely absent maternal body which allowed the interventions of an other body to claim authority over the products of conception; both images also produced arguments about identity, based on assertions about the necessity of medical procedures required to manipulate unborn creatures; both likewise acquired meaning in relation to what was outside of them, primarily other images and historical discourses concerned with who should properly control the realm of reproduction. My comparative method highlighted the complexity and variety of visual forms of communication, while undermining simple understandings of progress that delegate the early modern period to the distant past, utterly divorced from contemporary scientific practice. Early modern medical practitioners, such as Peau, arguably had an advanced understanding of the way in which visual representations can actively produce rather than merely reflect knowledge.

My second question asked what artists could contribute to exploring the visual dimensions of current debates about biotechnology. This section did not directly concern the cultural construction of healthy and unhealthy human embryos, but instead turned to the wider domain of technoscience that underpins many of the current discussions about these beings. Although only a small selection of bioart production was discussed, it revealed that artists are materially exploring the manipulations of biotechnology, encouraging more sophisticated understandings of both science and scientists, while drawing attention to the *habitus* developed in laboratories. Audiences will be disappointed by bioart if they are seeking dogmatic positions either for or against stem cell research, the creation of animal–human hybrids, or particular reproductive technologies. For the most part, the artists involved do not make prescriptive arguments but instead offer new ways of looking at and thinking about various forms of biotechnology. I contend that this kind of practice has the ability to open new questions, offering a ‘thicker’ debate about biotechnology, particularly with regard to ethical issues.

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