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Science as Father? Sex and gender in the age of reproductive technologies

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Pregnancy and motherhood are central to the understanding of what a woman is, and function as a basic distinction of women and men in Western culture. Today, we can encounter the following image in newspapers and magazines, used to illustrate articles on new achievements in medical technologies: in the forefront, a doctor holding a baby; more distant and unclear, the mother, placed behind him. The father is rarely present. Since the understanding of male and female is so basically related to reproduction, my question is how changes in the reproduction process due to new reproductive technologies affect the understanding of gender?

Science and technology have not only been foundational for the construction of modern societies, they also underpin the construction of human models of thought. This is e.g. evidenced in the increasing use of genetic explanations of human behaviour, or in the use of concepts from computer programming to illustrate human reasoning. Whereas technology was previously placed in the realm of manufacturing, the new biotechnologies deal with processes in the human body, and thus with nature rather than culture. Since new technologies transgress former limits for technological intervention, they are not easily conceptualised and therefore advance new models of thought with regard to "the nature of the natural".

"After nature" (Strathern 1992) is one of several titles from the last decade which suggest that we are now past or beyond nature. This may be the outcome of a need for a new understanding of nature, partly stirred by new technologies transgressing the distinction between nature and culture, such as new reproductive technologies (NRTs) and genetic technologies. At the same time, however, one may also argue that the common Western understanding of nature – as 'pure' nature distinct from culture – actually always was a cultural product. Still, it remains a basic conceptual distinction in Western culture, and it is paralleled in the division between sex, understood as nature, and gender, understood as culture.

The aim of this article is to bring together perspectives from feminist research on new reproductive technologies from the field of Science and Technology Studies and research on the female body from the Social Studies of Science, and then relate these to theoretical discussions of the distinction of sex and gender (e.g. Butler 1990, 1993, Moi 1999). The distinction of sex/nature and gender/culture has, as it were, a meeting point in the symbolic association of female-to-nature and male-to-culture (Ortner 1974). Thus, nature also has a symbolic dimension. The symbolic connotations referred to by Ortner are based on an understanding of women as being closer to nature by way of their exclusive capability of conception and procreation. Conception can now take place outside of the female body, and a test-tube baby is partly a product of science; in other words, a product of culture rather than of nature.

There is at present a feeling that there is 'less nature' in the world than there used to be, Strathern states (1992), with reference to her research on reproductive technologies. Again there is confusion: since more technology means less nature, this should necessarily imply more of the opposite, namely culture. But technology is not really apprehended as culture either. What makes technology frightening to many, Strathern argues, is that they see technology as 'a kind of culture without people'.

Since it is man-made and even man's tool for manipulating nature, technology is definitely not nature. However, whereas culture is thought of as the specifically human aspects of the world, technology usually is not. The image of the cyborg is so powerful exactly because of its blend of two opposites, the human being and the machine. This is an example of the type of transgression of boundaries which makes new technologies disturbing. And moreover, what does love have to do with science and technology? According to the title of a book by one of the medical experts within the field, *in vitro* fertilisation is nothing less than 'a blend of love and science'.[i]

The new reproductive technologies affect several of our conceptual distinctions, and most basically the one between nature and culture. This includes the understanding of reproduction as natural, biological processes and of the body as a product of nature. The process of reproduction is also central to the understanding of sexual difference, in the sense that the abilities to conceive and give birth to children are generally considered to be features which distinguish woman from man. Questions of the body, understood as biology, long remained a sensitive topic in feminist research. Now, however, the body is a most central theme in feminist discourse. Time was perhaps not ripe to raise questions about the body until new studies of science paved the way for studies which released the body from 'biological destiny' (Bleier 1984, Keller 1985, Haraway 1989, 1991). Studies have questioned what a natural body actually means, pointing to the paradox that there are *cultural* expectations to what is *natural* about it (Martin 1987, 1995, Oudshoorn 1994, Schiebinger 1999). Moreover, if one does not acknowledge the distinction of male and female as a product of nature, how does one account for the fact that this difference, in cultural terms, to such an extent became seated in the body?

Since the cultural understanding of maleness and femaleness is closely connected to the reproduction process, changes in this process provide us with empirical material for exploring changes in cultural theories of sex/gender. The first type of material that will be discussed in this article is anthropological research on the relationship between nature and culture in Western conceptions of reproduction. Can insights from this field shed light on contemporary discussions of the notions of sex and gender within feminist theory? Secondly, historical studies of the medical sciences illuminate how an understanding of two sexes came to be based on the anatomy of the human body and always related to women's role in reproduction. This brings us to the theme of new reproductive technologies. When the new technologies are presented to the public, new stories of conception and procreation are created.

A theoretical point of departure is to consider science as an important provider of cultural models. Science tells us stories of 'how things are', for instance revealed by the way historians and social scientists relate how science has explicated sexual difference (e.g. Laqueur 1990, Martin 1991). The aim of this article is to study new reproductive technology as a provider of new cultural models for understanding the relationship between nature and culture, and how this relates to the distinction of sex/nature and gender/culture.

Nature and culture - troubled relationships

Reproduction is on the one hand considered to be a natural process, but is on the other hand deeply embedded in social institutions, in particular in those of kinship and the family. Generally, the anthropological idea of kinship has been that facts of nature were transformed into social and cultural constructs (Strathern 1992). This means that

according to a traditional understanding of kinship, people are related to each other through 'blood', or, in other words, through natural facts of genetic parenthood. On this natural basis, people have constructed a variety of cultural systems of kinship. Again there is a conceptual distinction between nature in the sense of blood relations and culture in the sense of kinship systems.

In different kinship systems there are various cultural explanations of how people become related to each other, of which bonds are the closest (such as matrilinear versus patrilinear kinship systems), and the relative importance of biological and social relationships. In Western culture, motherhood and the mother-child relationship are considered to be primary relationships. The historian John R. Gillis (1995) reminds us that the recognition of motherhood and fatherhood is not a result of biological facts. Rather, they are varying cultural theories of reproduction which are related to a broader belief system. The dominant Western cultural understanding is that of *matrigenesis*, according to which the woman gives life to a child. Also the mother-child relationship is conceptualised as a product of nature – the maternal instinct – whereas there is no corresponding concept of fatherhood as a natural phenomenon. In contrast, anthropologist Carol Delaney (1981) presents a *patrigenetic* theory of reproduction based on her fieldwork in a Turkish village. Here, the father is considered to be the one who gives life. Metaphorically, the man has the seed, whereas the woman is the passive field, receiving and nurturing the seed. In order to be recognised as an adult man it is necessary to have children. In Western culture, however, the woman 'gives life', and to give birth to a child is simultaneously to give birth to herself as a woman (Gillis 1995).

In his book American Kinship, David Schneider (1980) depicts sexual intercourse as a core symbol of the white, middle class family. "It is the symbol of love which links conjugal and cognatic love together and relates them both to and through the symbol of sexual intercourse. Love in the sense of sexual intercourse is a natural act with natural consequences, according to its cultural definition" (Schneider 1980:39). Through sexual intercourse the social relationship established by a couple is transformed into nature by way of conception and birth. Family members become connected 'by blood' through their children. There is, accordingly, a reverse order whereby culture in the sense of marriage or partnership comes 'before nature'.

An instance where the social overrules the natural is the *pater est* rule. Disregarding genetic fatherhood, this rule recognises the man who is married to a woman who gives birth to a child as the child's father. The *pater est* rule has until now been the general rule for legal fatherhood in Europe. One may ask why social parenthood has been privileged through this rule and also why there is now a debate raised by voices arguing for recognition of genetic parenthood instead. A technological explanation for the current opposition to the rule might be that fatherhood 'by nature' could not be proved until recently, whereas there is now an appropriate technology for this purpose. Another explanation may be an increasing recognition of genetic heritage as decisive for who a person 'is'. in parallel to advances of genetic science, nature may be gaining ground at the cost of culture in the understanding of human qualities, and this also applies to gender.

In Western culture, gender has, as has kinship, implicitly been acknowledged as a social and cultural construct 'built on top of' the biological differences of human bodies. The distinction between sex and gender can be traced back to the 1970s, to the work of sociologist Ann Oakley (1972) and anthropologist Gayle Rubin (1975), who

for decades inspired studies of gender differences as socially and culturally constructed. In the 1990s, however, many writers have questioned the distinction as a tool for analysis, because it implies that there is a phenomenon of sex that is pure nature (Braidotti 1994, Butler 1990, Haraway 1991). The introduction of the concept of gender was in fact not aimed at questioning biological difference as such, but rather at questioning biological difference as a basis for social difference. The main criticism from feminist researchers at that time was the lack of accordance between the natural differences of anatomy and the social and cultural understandings of male and female. The concept of gender was an analytical tool necessary for following up Simone de Beauvoir's famous statement that one is not born but rather becomes a woman (Matisons 1998). Solheim (1998), however, suggests that de Beauvoir was wrong: in modern Western culture one is actually born a woman or man, with sex as well as gender, because the difference already exists as a symbolic reality. Bodily differences are key symbols of maleness and femaleness. Studying the body not only as a natural but also as a cultural phenomenon is one way of avoiding a dichotomy of sex and gender. According to Moi (1999), de Beauvoir already bridged such a dichotomy with her concept of the body as a situation, a concept which implies unity between the biological body and the person's lived experience.

It is interesting to note that in Norwegian, the word *kjønn* has covered both aspects during several decades of feminist research, whereas in Swedish, the concept of *genus* was introduced as a translation of gender. It might be tempting to state that Norwegian researchers were aware of the problem of constructing a divide between 'the natural' of the body and 'the cultural' of society, undercommunicating the cultural aspects of anatomy, sexuality and reproduction (Berg and Lie 1995). It seems more to the point, however, to say that the concept of *kjønn* generally has been used as an equivalent to gender.

In feminist research, gender, being recognised as the questionable and changeable part of the sex-gender relationship, has been the focus of attention. In this sense, one may say that in feminist research, there was no sex, only gender (Nilsson 1996). Separating sex from gender and devoting all the attention to the latter actually implied a silent acceptance of biological differences as the unquestionable or doxic aspect of the topic. Thus, in a similar manner as kinship, gender has implicitly been held to be a sociocultural layer on top of a biological core. Whereas the core mainly was left in peace because of its accepted unchangeable character (except within science fiction novels), the sociocultural patterns, considered to be the changeable segment, became the focus of gender research as well as political debate. Thus, if we refer to Strathern's terms of the relationship between nature and culture more generally, the symbolic order has not been questioned as long as a biological core of sexual difference was left in peace.

Stories from science

During the last decade, however, the understanding of the natural body has painstakingly been questioned, and every aspect of it has been scrutinised (e.g. Gallagher and Laqueur 1987, Johannisson 1994, Rosenbeck 1992). This investigation has not been undertaken by anatomists, but by social scientists, historians and philosophers, who have put fields such as the history of anatomy and other medical sciences under scrutiny. The order of sex versus gender is radically questioned, and in a new way. One may say that feminist researchers formerly aimed at widening the scope of social and cultural factors, i.e. gender, thereby diminishing the effects of

biology. The contribution from science studies, however, consists of destabilising the understanding of sex as nature.

The possibility of 'reverse orders' between biology and social arrangements is what Thomas Laqueur has argued for in his historical studies. According to Laqueur (1990), the acknowledgement of biological differences as decisive for social gender differences is a cultural construct which appeared in a particular epoch of Western history, whereas other theories of difference have been prominent at other times. From antiquity until the Enlightenment, no fundamental difference between the male and the female body was acknowledged. The male body was used as the model for the human body, and the only difference between the two was that the female genitalia were turned inside into the body. Except for this difference (inside-outside), the female genitalia were considered to be essentially the same as the male genitalia. Even the terminology was the same for the female and the male organs, and special terms for female reproductive organs did not exist. Women were presented as inverted, and hence less perfect, men.

According to Laqueur, *difference* was acknowledged, but it was accorded to gender and not to sex. Gender was an important category, in the sense that it mattered a great deal in social life whether one was a man or a woman. But there were no efforts to ground social roles in biology, since social categories were also considered natural. Biology and social roles both mirrored the cosmic order. There was, accordingly, a gendered social self, but only one body or one flesh. In other words, one acknowledged two genders but only one sex.

The difference from the present model of understanding cannot be explained by the lack of anatomical knowledge alone. Dissection of male and female bodies had been done for centuries. And moreover, "oppositions and contrasts between the female and the male, if one wishes to construe them as such, have been clear since the beginning of time: the one gives birth and the other does not." (Laqueur 1990:9) Set against such momentous truths, he says, the different 'discoveries' inside the body seem to be of relatively minor significance.

In our times, however, it is hardly controversial to refer to a biological difference of male and female that is based in the sexual organs. In fact, it is precisely the difference of whether one is able to give birth which has been given status as a momentous truth – as a proof of a basic difference. It is precisely this fact that is shaking with new reproductive technologies, which serve to question the naturalness of the processes of conception and procreation and the naturalness of women's ability to give birth.

According to Laqueur (1990), during the eighteenth century, there occurred a change in understanding from a one-sex to a two-sex model. Once the two-sex model had gained recognition, one started looking for *the* organ of the body, particularly of the female body, which had the essence of sex, or rather, the essence of femininity. During the nineteenth century, different parts of the reproductive organs were suggested to be this vital organ. There are, however, other historical studies of the body which question the acknowledgement of the reproductive organs as decisive for sexual difference.

The history of the human skeleton reveals that it was, like the rest of the body, considered to be one and equal until the eighteenth century. Moreover, arguing that there were sexual differences in the human skeleton was even more radical than

according such difference to the genitals. Whereas the skeleton was positioned as the basis of every other organ of the body, the genitals were not accorded a similar central position. Thus, if skeletons were different, this would imply the existence of differences in all other organs ‘attached to and molded by the skeleton’(Schiebinger 1987:53).

The first acknowledged drawings of a female skeleton were made in the eighteenth century. Before that time, there were only drawings of the *human* skeleton. There were, however, at the time they were introduced, actually two slightly different drawings of the female skeleton fighting for acknowledgement (ibid.). The first of these, drawn by Soemmering, had smaller ribs than male skeletons. He argued that women’s hips are actually not much broader than men’s, but when the upper body is narrower, the hips seem to protrude on the sides. The other skeleton, drawn by d’Arconville, his female competitor, depicts the skull (incorrectly, Schiebinger says, i.e. not in accordance with the knowledge of today) smaller in proportion to the body compared to the drawing of the man. The ribs are very narrow and the hips much broader than a man’s. Thus Soemmering suggested that his competitor actually used as her model a woman who had worn a corset throughout her life. Still, the one with the broader hips was the for a long time the acknowledged version, and the argument against the one drawn by Soemmering was exactly that “it contributes nothing to the comparison [i.e. between male and female skeletons] which is intended” (Schiebinger 1987:59). The debate on the skeleton may on the one hand be seen to draw attention to other aspects of maleness and femaleness than the sexual organs. On the other hand, the protruding pelvis became essential in the debate, focussing explicitly on women’s role in reproduction.

A central question is how these anatomists picked out the models upon which they based their drawings. They did discuss the problem that there actually is considerable variation in human bodies. So, on which other basis could one pick the models than from the prevailing ideas of, or, more precisely, ideals for the male and the female body? They were ideals in the sense that the models were chosen to present the most perfect result of the Creation. Thus one may say that during the Enlightenment, science replaced religion as the source for explaining differences between women and men in society. Still, it simultaneously serves to exemplify the fact that science and religion not necessarily are two competing belief systems.[ii]

The diffusion of sex through the body

In the beginning of the twentieth century a radical shift takes place, changing the image of sex as seated within the body. This is when sex becomes located in the hormonal system (Oudshoorn 1994). After this shift, Nelly Ousdhoorn argues, we have started talking and thinking about our bodies in new ways. As a consequence, not only do women and men have different bodily organs with different functions, but there are chemical substances directing us into different emotions, behaviour and degrees of fitness for social roles and functions.

Locating sex in hormones meant that it became more intangible and, as it later appeared, also less dichotomous. Hormones could not be localised to a specific place within the body, not be depicted, and not even easily be isolated for research purposes. In fact, sex hormones were written about in scientific publications before they were actually there as ‘facts’ in the sense that one was able to isolate them and extract them from the body. While scientists were struggling to isolate the male and

the female sex hormone respectively, it appeared that both types of hormones were present in both men and women. When hormones were produced for therapeutic application, the idea was to use them sex-specifically: in clinical trials, female sex hormones were prescribed for women and *vice versa*. Practitioners, however, came to recognise the 'bisexuality' of the hormonal system as a reason for unorthodox treatments: "The recognition of the fact that the living organism, male as well as female, is bisexual in disposition, gave rise to the introduction of paradoxical sex hormone therapy" (Petterson 1933, quoted in Oudshoorn 1994:106). Consequently, there were reports of quite successful trials of treating women with male sex hormones for exactly the same indications as those for which one prescribed treatment with female sex hormones: for menstrual disorders, psychological disorders and the menopause. In the end, however, the prescribed medical care consisted of treating women with female hormones. Hormonal treatment of men was introduced on a much smaller scale.

With sex difference now seated in the hormonal system, one had gone a long way from sex as fixed in a specific organ to:

- a chemical process that extends to the whole body;
- a matter of process and complicated connections, thus neither fixed nor easily identified;
- a matter of degree, not dichotomous;
- and a hormonal level which is manipulable.

Today the research on sexual hormones is known mainly because it led to the invention of the Pill, the most widely known and widely used NRT. What scientists were looking for was a universal means to control reproduction, to be used by all women, all over the world. A particular of this process is that in order to make and test the Pill, women had to be constructed as equal. And making them equal implies making women in general unequal to men.

The scientists did not only have to deal with differences of a social and/or cultural character, they also had to turn different physical bodies into an abstraction of identical reproductive functions. All this variety was transformed into something equal in a very special way. The women chosen to be the testing ground, the inhabitants of a particular housing project in Puerto Rico, tended quite often to withdraw from the project (ibid.). They quitted the experiment for social and cultural reasons such as spouses' rejection of contraceptives or opposition from the Church, because of the tedious routines and frequent controls and because of unpleasant side effects. The problem of the high drop out rates was very elegantly solved by transforming the number of women into a number of menstrual cycles. Thus those who had dropped out and newly recruited women were all counted equally: as numbers of menstrual cycles, together representing impressively high numbers. Moreover, not only were real women transformed into menstrual cycles, but the menstrual cycles were also made equal by prescribing a certain cycle for taking the pills. It was important that women still have their menstrual periods because this was an argument for the Pill as not 'going against nature'.

The Pill is an example of how the natural body may be modified by cultural means, changing the menstrual cycle and separating sexuality and reproduction. Hormonal research actually entailed that one had found a biological basis of sex difference that could be manipulated and changed. The discovery of the sexual hormones could have

led to a modification of the two-sex model. Paradoxically, in parallel to this new way of defining sexual difference as more fluid and less dichotomous, hormonal treatment is today used to make people *more* in accordance with the norms for the male and the female body respectively.

Anne Fausto-Sterling, a biological and medical scientist, states that according to nature (i.e. biological bodies), two sexes are not enough. At birth, there is so much natural variation that we need at least five sexes, although these categories of course also are a simplification of the natural variation (Fausto-Sterling 1993). The five sexes are ironically suggested as "female, ferm, herm, merm and male". The herms are the real hermaphrodites, born with male as well as female sexual organs, though sometimes grown together within the same organ. The ferms and merms, however, have a chromosomal combination which is not concurrent with their genitalia; ferms having the female combination but sometimes male external genitalia in addition to the female ones; merms have the male chromosome combination but partly female genitalia. Today, there are effective means for transforming most of these various forms into two sexes through a combination of surgery and hormonal treatment.

It is a paradox that the discovery of sexual hormones did not lead to a less dichotomous model of sex and sexual differences. The discovery of hormones meant that differences might be considered a question of degree, that the existence of variations in the hormonal composition of individuals within the two groups was apparent, and it was acknowledged that both groups had male as well as female sexual hormones. The possibility of hormonal treatment meant that sex became easier to manipulate than before. Still, the dichotomous view of the two sexes persisted. Hormonal treatment actually brought about more efficient means of accomplishing treatment into sexual dichotomy. Hormonal treatment may be used as a means to restore 'failures' into 'correct' natural varieties of male and female. Thus, nature has more than two sexes, whereas culture, apparently, has only two.

New stories of procreation

The Pill also brought about a revolution in the social arrangements of sexuality. The separation of sexuality and procreation disturbed the belief in the naturalness of the nuclear family as the social arrangement enveloping the process of reproduction. Moreover, the separation of sexuality and reproduction has accelerated with the new techniques for assisted reproduction, since what is necessary for procreation is an egg and a sperm and not a woman and a man. As previously mentioned, anthropologists have reminded us of the varying cultural theories of reproduction. In Western theories of procreation, the mother and the child give birth to each other. A mother gives birth to a child, but the child also makes her become a woman (Gillis 1995). Changing reproductive practices hence affect the understanding of what 'turns a woman into a woman'. This brings us to the question of how the new processes of reproduction are conceptualised in relation to the nature-culture distinction and the theory of the *matrigenesis*.

Stanworth and others (1987) have made the observation that medical doctors working with infertility appeal to a *natural* desire, even a natural right, for people to have children of their own. There are actually two terms for these techniques, the one in a marked contrast to the other, thereby indicating two competing cultural images. On the one hand, NRTs are depicted as a helping hand for the body's natural reproductive functions. As mentioned, people's *desire* to have 'natural born' babies is also seen as

a product of nature. Hence the term *assisted* reproduction, which connotes that one assists nature when something unnatural has occurred, when nature does not function the way it normally or *naturally* should. However, the same treatments are spoken of as *artificially* assisted reproduction, introducing the concept of the artificial as opposed to the natural. The latter term indicates that the use of NRTs means going against nature. This implies an understanding of nature as natural variation, including infertility, not to mention miscarriages and disabilities. Subsequently, some depict scientists as 'playing God' and gambling with nature.

Sarah Franklin (1995) discusses an enlightening case of how NRTs are introduced to a broad public.[iii] [iv]The case illustrates how science as well as public debates over NRT begin to influence the understanding of the process of reproduction in general. When presenting the new reproductive techniques, the point of reference is natural reproduction. This means that natural reproduction is simultaneously reinterpreted and presented in new ways.

Part I of the film, on natural procreation, begins with the statement that the birth of a baby is a miracle. [v] In what is to come, it displays that it actually is a miracle that conception can take place at all. Nature is depicted as utterly wasteful: "Whereas a woman has over 2 mill unique egg cells in her ovaries, these are steadily reduced over time. Only a tiny proportion will ever achieve fertilisation; an even tinier fraction will implant." (Franklin 1995:329). Similarly, the voice-over relates how millions of sperms participate in a race where there can only be one winner, whereas millions will die at every stage of their journey. Genes constitute the other important theme of the story. The voice-over tells us that the recombination of the two sets of chromosomes is the precise moment of conception whereby the baby inherits a unique genetic composition from its parents, different from anyone ever before. This is depicted as a moment of extreme risk: chromosome disorders, miscarriage and ectopic pregnancy may occur. Then the film follows the development of the fetus, and ends with the birth of a baby.

Part II of the story about NRT begins with an explanation of how the two parts of the film are interlinked. A medical specialist states: "To understand infertility we need to start with an understanding of normal fertility. In fact, human fertility is not very efficient." Sarah Franklin comments this statement thus: "Describing conception itself as an obstacle course also makes sense out of the obstacle-course dimension of IVF [in vitro fertilisation]; 'natural' and assisted reproduction come to appear more similar, both characterised by comparably high failure rates. The two kinds of conception become complementary: if IVF is difficult and largely unsuccessful, it is not surprising since the natural process is so badly designed. Indeed, it is notable that both IVF babies and unassisted babies are described as 'miracles' in these films: they are thus conflated" (Franklin 1995:332).

The author opens our eyes to how NRTs may imply a redefinition of reproduction in general. Ironically, however, I think she contributes to this process when she, apparently unhappy with the term 'natural' babies, uses the term 'unassisted babies'. This is a perfect illustration of how meanings derived from the world of assisted reproduction are influencing the way we think of what we had before. The author does exactly what she criticised, she namely redefines the one in the light of the other, and conflates the two of them. I think this just reinforces her argument: we are in a process of redefining what we understand as nature and natural processes.

Whereas the two films use normal reproduction as a background for presenting assisted reproduction, Franklin's analysis draws attention to the opposite: how the story of normal reproduction is (re)told with reference to assisted reproduction. In the story of normal reproduction, attention has shifted from early human development, which we have previously been told is the miracle (especially after the Nilsson photographs of the fetus), to the moment of conception. The miracle lies in the combination of genetic material. Thus the miracle, as well as the risks involved, are shifted back in time; from the development of the fetus within the mother's womb, to the time of conception and even before that. Another point is that the risks of pregnancy are emphasised. As a consequence, prospective parents are not assured that nature actually takes care of these miracles. Thus science becomes the most trustworthy caretaker.

The research on the different techniques of assisted reproduction has resulted in more detailed knowledge about conception, embryos and fetuses. Previously concealed within the female body, every step of the process is now documented by technologies such as ultrasound, scanning and laparoscopy. More detailed medical knowledge resulted in a splitting apart of the process of conception and procreation into separate, definite stages. In the traditional understanding of conception and procreation as a natural process, woman and fetus were held as one. Due to medical advances and the new transparency of the body, the unity of woman and procreation has been dissolved (Ginsburg and Rapp 1995). New technologies give us 'direct' access to knowledge about the fetus, whereas the pregnant woman was the source of information before. Previously, she was the one who had the knowledge of when conception took place, knowledge which was necessary for determining the due date of delivery. Today, the date is set on the basis of information from the fetus, available through ultrasound (Sætnan 1997).

The fetus has to an increasing extent come to be understood as a separate being, and the unity between woman and fetus is therefore disintegrating. The fetus has become visible by ultrasound from a very early moment, giving the parents as well as the medical personnel an image of a separate being rather than a part of the woman's body (Duden 1993). By stressing the unique genetic combination from the moment of conception, the representation of the embryo as different from and therefore distinct from the mother's body is emphasised. The fetus has even become a separate patient for treatment within the womb, and is presented as an individual with legal right to life in the abortion debate.

An implicit message of the new stories of procreation is that science has gained insight into the totality of the process. The process is no longer dependent on different and imperfect bodies, because scientific insight implies control over reproduction. Symbolically, woman is no longer 'the creator of children', in accordance with the cultural theory of *matrigenesis*, but rather one of several participants in a process. This is most clearly the case when NRT specialists are involved. Ever more technology is involved in 'normal' pregnancy and birth, however, and specialist treatment may be introduced at later stages because of possible disorders from which 'normally' conceived babies may suffer. Reproduction is therefore increasingly separated from nature as well as from its unity with the female body. We then return to the question initially raised: if science questions the naturalness and uniqueness of women's abilities to conceive and bear children, is this no longer what constitutes woman as distinct from man?

Crumbling foundations?

The aim of this article has been to draw attention to the broad cultural effects of science in the sense that science is an important provider of cultural understandings of maleness and femaleness. Feminist science studies have revealed how science continually provides new models for the understanding of male-female distinctions as rooted in nature. During the last centuries, scientists have been searching through the entire body for difference, especially focussing on differences related to the process of reproduction. The Western understanding of human reproduction is based on a scientific understanding of biological processes, in fact increasingly so as new reproductive technologies extend our knowledge of these processes. Although the models of explication are changing, science still holds the ground as the basis for understanding. The hegemony of scientific explanations in Western culture after the Enlightenment may reveal why the understanding of gender difference to such an extent was searched for in the biological body.

Science is, in the Western mind, the provider of knowledge to which religion is generally posited as a contrast. Still, the Western idea of "one child, one genitor" co-exists with the Christian belief in one God, the Father, indicating that science and religion often function as one belief system and not as contrasting forms of knowledge (Delaney 1981, Franklin 1997). The father has held a significant symbolic position not only as genitor but also as *pater familias*. This position crumbled due to changes in social organisation and the diminishing role of the family, but also due to the separation of sexuality and reproduction. At the same time, science has extended its influence over the reproduction process, from the periods of pregnancy and birth, to the moment of conception and can symbolically appear as the creator, or the new father.

The *matrigenesis* has been a coherent model upon which thinking about conception and motherhood has been based. It establishes birth and motherhood as most central to what a woman is, and woman and man as different on the basis of their biological functions in reproduction. In her account of the story of the egg and the sperm – the way in which they are presented in medical textbooks – Martin (1991) highlights how this is a powerful story of the understanding of maleness and femaleness. The sperm is presented as swift and on the move, competitive and aggressive. The egg is depicted as stable, passive and nurturing. In the Petri dish, however, they can hardly be assigned such contrasting roles, with the sperm in a less heroic and self-sufficient position. More importantly, the Petri dish challenges the understanding of conception as nature.

Reproductive, genetic and other medical technologies concerning the human body imply that bodies can no longer be conceptualised as given facts upon which social and cultural systems should be built. New technologies can 'make or remake' biology and thus affect the understanding of what nature or biology is. Studies of NRTs illustrate ways in which the understanding of natural reproduction is changing at present. Examples here are a redefinition of conception as the combination of genetic material, entailing new ideas of what conception is and when it takes place, and ever new definitions of when a new human being comes into existence both legally and culturally. All stages of the reproductive process are now increasingly being controlled. And the control of reproduction is in a sense the ultimate control of nature.

What is actually interfered with in our times, according to Strathern (1992), is the Western idea of a natural fact, or, in other words, the idea of the difference between

natural and cultural facts. Nature is no longer the solid basis it used to be in our understanding. Culture has entangled itself into it from different sides and distorted the concept of ‘pure nature’. New concepts indicate that reproduction may be ‘assisted’ or ‘artificial’, the degree of maleness and femaleness can be manipulated by surgery and hormonal treatment, as can other biological processes such as ageing and growing to a certain height. Under such circumstances, it becomes harder to perceive a biological core as a stable basis for gender difference.

However, feminist research has long questioned a biological basis for cultural understandings of gender. During the last decades, feminist researchers have sought to broaden the understanding of cultural factors and diminish the impact of biology in the perception of sex/gender. For centuries, the prevalent cultural theory of gender difference has been that there is a basic difference between male and female that is rooted in biology. Different ways to ‘attack’ this understanding has been a main purpose of much feminist research. At present, there is a prevalent unease with the conceptual split of sex and gender, because the notion of sex indicates that there exists something that is ‘pure’ nature in the distinction of male and female. The last decade’s theorising has focussed on the sex-gender distinction and how it can be bridged (Butler 1990 and 1993, Moi 1999). The human body became a vital theme in the theoretical debate, and Moi (1999) indicated that post-structuralists try to get away from biological determinism by redefining the body; from a biological to a purely cultural product. The cultural studies of science presented in this article represent one such radical turn away from biology, or sex, in the understanding of male-female distinctions.

The question remains, however, to which extent nature’s stronghold over culture has been weakened in the cultural understanding more generally. Feminist research, mainly based in the arts and social sciences, has been of vital importance for the general societal understanding of sex/gender. This notwithstanding, social and cultural studies have never gained a status similar to that of science as a solid foundation for knowledge. The aim of this article was to study science as a provider of cultural models of the relationship between nature/sex and culture/gender and how these understandings are changing. New technologies like NRTs trigger a need for new conceptualisations of reproduction and of the gendered bodies involved in the process. In one sense, NRTs may destabilise the understanding of nature as more basic than culture because nature proves malleable. In another sense, it strengthens the notion of science as provider of insight into and control over nature. It thereby reinforces the status of science as explicator and provider of models of understanding.

Finally, one may ask if there exists an ever widening gap between feminist theories and ‘folk theories’ of gender. The radically new turns in feminist research have developed at the same time as the new biotechnologies and particularly gene research have generated enormous interest from the media and the general public. The message is that science increases the knowledge of why human beings are the way they are, including the knowledge of differences between them. The new biosciences have paved the way for a common understanding of genes – in other words, nature – as the decisive feature for a person’s looks, interests, skills and personality. Included in this is the understanding of gender differences as rooted in the genes. Thus, while feminists have remodelled the notion of sex/gender in the sense that a biological understanding is nearly eradicated, science has provided another powerful model where human qualities are still based in nature.

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[i] Volpe, E P 1987: *Test-Tube Conception: A Blend of Love and Science*, quoted in Balsamo 1996

[ii] The powerful stories about Darwin and other scientists have conveyed the battle of science versus religion. This is the official story of science, the way it is presented in schoolbooks etc.

[iii] The case is a two-part docudrama produced for BBC by an infertility specialist. Part I, entitled 'The World of the Unborn', tells the story about normal, or natural, conception. Part II deals with the causes and treatment of infertility with the more stirring title of 'The Agony and the Ecstasy'.

[iv] Another interesting case is represented in the ongoing research of Mette Bryld, University of Southern Denmark, dealing with how IVF is presented in children's books as new stories of procreation. Paper presented at the 4th European Feminist Research Conference, Bologna 28.9-1.10.2000.