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Abstract: As we enter the fifth decade of human IVF, this technique presents us with a paradox. On the one hand, IVF has become more regular and ordinary, even having become a new norm of social life. On the other hand, as IVF has become coupled to an increasing range of cognate applications such as ICSI, PGD and gestational surrogacy, as well as human embryonic stem cell derivation, it has become, as Alice might have said, 'curiouser and curiouser'. Five million miracle babies later, IVF can be seen as the source of a basic change in how reproductive biology is understood - not only scientifically and medically, but socially, ethically, and economically. In this article, I suggest that while the passage of time may have allowed IVF to become more 'routine', the opposite is also true: with the benefit of hindsight we can also appreciate the radical changes IVF has introduced not only to our understandings of reproduction, but technology, kinship, and genealogy. Learning from this paradox must be part of the legacy of IVF's first half century if its future evolution is to be directed wisely, safely, and conscientiously.

Cover Letter

21 May 2013

Please find attached my submission for the Futures in Reproduction meeting held in December 2012, at Churchill College, Cambridge.

Sarah Franklin

***Response to Reviewers**

13/08/13 There is no response to the reviewers. Catherine Field

Conception Through a Looking Glass: the paradox of IVF

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Abstract:

As we enter the fifth decade of human IVF, this technique presents us a paradox. On the one hand, IVF has become more regular and ordinary, even having become a new norm of social life. On the other hand, it has arguably become, as Alice might have said, 'curiouser and curiouser', with the development of its applications such as ICSI, PGD and gestational surrogacy, as well as human embryonic stem cell derivation. Five million miracle babies later, in the midst of 'the age of biological control', IVF can be seen as the source of important changes in how reproductive biology is understood – not only socially and ethically, but medically and in terms of basic science. In this article, which reviews three decades of social scientific research into IVF, I suggest that while the passage of time may have allowed IVF to become more 'routine', the opposite is also true: with the benefit of hindsight we can also appreciate some of the more radical changes to which IVF has contributed, altering our understandings of parenthood, kinship, fertility, and technology. Learning from this paradox must be part of the legacy of IVF's first half century if its future evolution is to be directed wisely, safely, and conscientiously.

Keywords: IVF, Ethnography, Robert Edwards, Assisted Conception, Kinship

Introduction

As the worldwide celebration of IVF technology following the award of the Nobel Prize to Robert Edwards in 2010 confirmed, this technique has become one of the most iconic biomedical innovations of the twentieth century, while also having become an increasingly normal and regular fact of life in the twenty-first. The claim that more than five million babies have been born from this technique, and that it is now used across the globe, were among the most widely reported facts about IVF in the media coverage following Edwards's death in 2013, which inevitably served not only to publicise his own accomplishments, but also the technique that made him famous, won him many scientific accolades, and changed the world he left behind. Edwards's relationship to the media had not always been so cordial (Edwards and Steptoe 1980:99). But despite the fact that he often resented its influence, and its frequent misrepresentation of both him and his work, it is to Edwards' credit that he nonetheless recognised, and accepted early in his career, the importance of the media's role in promoting and facilitating public debate of innovative new technologies such as IVF. He deserves contemporary praise for recognising that a robust social and ethical conversation would be a necessary part of IVF's translational success (Edwards and Sharpe,1971). Like his similarly-minded scientific colleague Anne McLaren, Edwards played an important part in initiating this conversation, both in the UK and elsewhere, by participating in many public events, and encouraging ethical and political debate about the complex intersection between reproduction and technology, especially during the period of active public and parliamentary debate over human fertilization and embryology during the 1980s. Like Ian Wilmut after him (Wilmut et al 2000), Edwards recognised that technological changes affecting the future of reproduction would require innovation in social, political, religious, and ethical life as well.

He recognised that many different kinds of conversations, including public consultations, parliamentary debate, scientific conferences, and discussions with patients would be crucial to the future of IVF, and for this reason it can be claimed that Edwards had an appreciation for what is sociological about the history of IVF as well as what is biological.

The sociology of IVF is now a major field of academic research, and in the wake of the rapid expansion of the IVF sector worldwide over the past 30 years, its importance as a means of understanding the transformation of both human and animal reproduction brought about through this technology has become more visible. Among the many features of IVF that remain poorly understood, for example, are the changing meanings of fertility, infertility, and fecundity to which it has given rise, both in public culture and within the context of reproductive biomedicine. Hence, paradoxically, although IVF was introduced in order to alleviate the burden of impaired fecundity, and is generally understood as a form of infertility treatment, the very existence of IVF and other assisted conception technologies has transformed how fertility, infertility and fecundity are understood, both privately and professionally. Never particularly clearly defined to begin with, and in many ways a highly contingent and transitory condition, the meanings of 'fertile' (demonstrably capable of reproduction) and 'fertility' (the condition of being fertile) have taken on new meanings in the context of the wide range of forms of technological assistance. Thus, while IVF and other forms of assisted conception technology have undoubtedly succeeded in alleviating the distress of unwanted infertility for many, they have, at the same time, also blurred the boundary between fertility and infertility, creating new forms of confusion about the very conditions they are designed to mitigate. This paradoxical transformation brought about by the introduction of IVF, and the new era of reproductive control that its debut inaugurated, constitutes both a social and a biological transformation of increasing importance in what has been called the biosociety. It is the nature of this transformation – manifest as social, legal and political change, as well as a coupling of technology to biology to achieve sexual reproduction – that remains to be more fully characterised in the wake of IVF's rapid worldwide routinization and normalization. This article attempts to survey some of the important lessons to be learned from the social study of IVF and ART over the past two decades, and thus to present a sociological perspective on assisted conception technology that can inform its future use.

The Sociology of IVF

The sociological approach to IVF by definition assumes that biology alone is not enough to enable successful human reproduction: human reproductive capacity is as highly organised socially as it is biologically. Although we tend to think of human reproduction as, at base, a biological capacity, the history of social theory from the late nineteenth century onward has demonstrated that the human capacity to reproduce offspring must be grounded in viable forms of social organisation in order to be successful, and that this process is a reciprocal one. Thus, IVF has been studied by social scientists as a form of social, as well as biological, reproduction because the same social patterning that influences how the biological capacity to reproduce can be expressed is in turn confirmed through the successful establishment of pregnancy and the birth of viable offspring. Marriage is the most obvious example of this reciprocal process – for marriage patterns both shape the outcomes of biological reproduction, and are themselves confirmed and supported by the birth of children (indeed children are important in no

small part because they offer living proof of a married couple's social viability). Many of the original debates, out of which sociology and anthropology emerged, concerned specifically the origin and purpose of marriage patterns, which of course vary enormously cross-culturally. Why, early anthropologists such as Edward Westermarck (1921) wanted to know, are they so diverse?

For a social scientist, the analysis of reproduction thus cannot begin from the point of view of innate physical capacity, or what we might call the nuts and bolts of the biological mechanisms involved in successful fertilization. Instead, the very fact that reproduction can be imagined as either innately biological (a relatively recent concept) or in terms of 'nuts and bolts', 'plumbing', 'mechanics', or 'giving nature a helping hand' indexes a specific pattern of social organisation, known anthropologically as a 'conception model' (Malinowski 1927). Even the conceptual model, which presumes as self-evident that reproduction is a part of nature, which is then shaped by culture or convention, reveals the sociological fact that there is always a cultural specificity to how reproductive causality is understood, or modelled (Strathern 1992). In other words, how people think about reproduction comprises an integral part of how they do it: human reproduction does not simply happen by itself, just as there is no 'automatic' biological mechanism that produces new human beings. As the history of anthropological research has documented (Strathern 1984), reproduction is universally subjected to elaborate social control, and is always modelled in a manner that parallels and complements other social structures. Consequently, fertility is always a social product as well as a biological one. The rules about who can reproduce with whom are considered to be among the first social prohibitions to mark the emergence of human culture (Levi-Strauss, 1969), and it is a sociological truism that the biological reproduction of new persons requires a complex infrastructure, including gender and sexual roles and identities, kinship and parenting structures, domestic and subsistence technologies, and so forth.

Although potentially counter-intuitive from the point of view of modern medical science, the sociological model of reproduction as an activity that relies on social as well as biological preconditions has important uses as an explanatory framework. For example, one way to explain the rapid transformation of IVF technology, within the space of just over a single generation, from a new and somewhat stigmatised technology into a regular fact of life, is that it is not only reproducing offspring, but other important, and much sought after, aspects of social identity with which procreation is intertwined. It is already well-documented that people seek out IVF for many different reasons, including wanting to be sure they have tried everything, satisfying the demands of in-laws, and not wanting to be seen to be complacent in the face of adversity (Franklin 1997). It has also been shown that people pursue IVF and other forms of assisted conception as a means of strengthening their conjugal, affinal, or kinship relations, and because of peer pressure (Sandelowski 1991, 1993, Ragone 1994, Lorber 1989). Many people who pursue IVF claim that they feel unable to attain adult status, a normal identity, or 'completion' in their lives in the absence of children of their own. As several social scientists have noted, IVF thus not only responds to the desire for children, but to the desire to achieve a parenthood identity: it is sought by couples and individuals yearning to repair a missing social role, as well as seeking medical treatment for a biological dysfunction in order to have children. IVF professionals are perfectly aware of this aspect of the IVF quest as well. After all, in an assisted conception unit, the conversations that take place in patient groups, between partners in a couple, at staff meetings, and in consultations between patients and the clinical staff, are not merely about reproductive biology: they cover almost every aspect of human existence.

To be provocatively sociological, it could be claimed that conversations (no doubt one of the oldest forms of human social interaction) are as important to the business of making babies as eggs and sperm. Even among birds, as Julian Huxley (1914) famously noted in his pioneering study of the courtship habits of the great crested grebe, complex communication strategies are integral to successful pairing. Although in theory birds and mammals, including humans, can, and no doubt do, reproduce asocially, reproductive success, as Darwin also noted (Darwin, C. 1859), is normally the product of highly complex social interactions as well as physiological ones (indeed according to most ethologists, these cannot be separated). As many zookeepers are equally aware, an inadequate social environment is a frequent cause of infertility for many species (not only for Pandas!).

Social interaction, including conversation, is also of course essential to the work of scientists, clinicians, and regulators and to the practice and governance of assisted conception. As Bob Edwards was aware, it is not only important for scientists to be engaged in a wider social and ethical conversation about the work they do: it is also important for scientists to promote such conversations in their daily practice, through their teaching, and in their relationships to graduate students. Perhaps because he was trained in Conrad Waddington's Institute in Edinburgh, where the canteen was a famously generative source of interdisciplinary dialogue, Bob Edwards inherited what might be called a 'conversational attitude' toward his work as a scientist (he also nearly became a politician, Johnson 2011). Like his mentor Waddington, Edwards passed the conversation and outreach 'gene' on to his own students, and although I never knew Bob myself, and only ever met him once, I was very much the beneficiary through his students of his bequest of an open-minded intellectual style, and the desire to engage with new ideas. In fact I had worked with several of Bob's students' students before I even realised this connection. It was no coincidence, I realised in retrospect, that Peter Braude, Sue Pickering, Virginia Bolton and Alan Handyside had all turned out to be key people in the often challenging process of trying to set up ethnographic studies of reproductive biomedicine over many years. Eventually in 2005, I also met Martin Johnson, who had taught all of these individuals at Cambridge, when we were introduced by Anne McLaren (also a Waddingtonian who was unusually receptive to social scientific research). I have been working with Martin Johnson ever since, and through him I have come to appreciate how much his own very unusually interdisciplinary, supportive, and open-minded approach to the study of human reproduction derives from his relationship to Bob.

The ART of Conversation

From the point of view of the lineages of teachers and students, and what is passed down not only through conversation and dialogue, but through styles of talking and listening, we can appreciate the importance of the art of conversation as a reproductive technology (or even ART) in its own right. This is one reason why ethnographers use in their work conversations both as a methodology and as a primary data source, known as participant-observation, through which the ethnographer relies upon his or her relationships to collect and analyse data. Such data can be surprisingly revealing. For example, when Peter Braude generously agreed to host my ethnographic study of PGD at his clinic in London, he invited me to meet everyone at a team meeting where he would introduce me and my project to his colleagues. This he accomplished through a very brief, and characteristically mischievous, verbal exchange with his team which neatly performed the social function of welcoming me to his clinic and

asking his colleagues to help me – although by appearing to do the reverse. I had not met Peter before I attended his clinic for the first time in January of 2001, where he introduced me to his team, at one of their Friday morning meetings. 'This is Sarah Franklin, an anthropologist', he said to the assembled group of at least 20 clinical and scientific staff. 'I have been to her website and I can't understand a thing on it' he announced, 'but her project has been peer reviewed so it must be kosher'. Somewhat taken aback by this brusque introduction, I was reassured quickly by members of staff who surrounded me afterwards and explained: 'Don't worry, he is always like that. He has a sign on his door that says: "In God We Trust. Everyone else bring your data"'. Being teased, I quickly realised, was being welcomed. It was the form of the message (mockery) that delivered its content (please be nice to her) as much as its content (she must be kosher). An ethnographic interpretation of this exchange would put emphasis on the formal social patterning it reveals, such as the style of professional culture it communicates, the group structure it affirms, and the function it performs of distinguishing insiders from outsiders. Peter's simultaneous welcome to me as both an insider, while designating me an outsider, was both astute and clearly communicated. Through his short and simple message, he was able to reinforce the rules and roles through which daily life in his clinic was organised, while also asking that these be adjusted to accommodate an unconventional newcomer.

Ethnographies of IVF rely on the collection and analysis of participant observations of this kind, known as fieldwork, which is then supplemented by background research, interviews, and/or focus groups. This empirical practice is in many ways the opposite of that which is employed by researchers working in the fields of social policy, psychology, socio-legal studies, or bioethics, as well as quantitative sociology, economics or political science. One reason for this is because ethnographic research is not orientated toward decision-making (although it can inform decisions) or judgements of 'should', 'ought', 'right' or 'wrong' (instead, judgements of this kind are used as data). Another reason is that ethnographic research, unlike normal science, is not hypothesis driven. For the ethnographer, a hypothesis is not a precursor to findings – *it is the finding*. As a form of highly qualitative research, ethnographic work is especially useful to generate research questions that might never even have been asked without extensive prior 'embedded' research. Good ethnography often generates surprising and counter-intuitive results. These, then, often make better starting points for quantitative research, because ethnography can generate questions that incorporate fewer prior assumptions from outside the context of research, and incorporate greater sensitivity to the 'indigenous' way of life. It is only from within the context of IVF, for example, that we can understand what it might mean to become 'a little bit pregnant' after an embryo transfer, or why this might make unsuccessful IVF even more difficult to accept. Above all, it is from the ethnographic point of view that we can better appreciate the importance of IVF as a context for remaking the meanings of parenthood and reproduction, as well as facilitating the business of making babies.

Ethnographies of IVF

Ethnographic studies of IVF and other new reproductive technologies (NRTs) began to be undertaken in the mid- to late-1980s and by the early 1990s a number of now classic studies had been published (Edwards et al 1993, Sandelowski 1993, Ragone 1994). Ethnographic studies of IVF in England (Franklin 1997), Egypt (Inhorn1994), Israel (Kahn 2000) and many other countries were published in

the 1990s, and the ethnographic study of reproductive biomedicine is now a major area of social science (Inhorn and Birenbaum-Carmeli 2008). These early ethnographies gradually established a sufficiently broad comparative framework from which it began to be possible to better characterise 'the social life of ART'. They were accompanied by an expanding literature on same sex parenthood, and postmodern or 'alternative' family structures (Weston 1997, Stacey 1992).

One of the key early findings of all of these studies was the extent to which the meaning of a biological tie, or a biological relative, could increasingly accommodate a surprising amount of adjustment – often despite also being seen as a fixed, objective and permanent form of social tie (Franklin 1997). For example, anthropologist Helena Ragone revealed how, in the context of surrogate parenting, the disparity in parental genetic contribution to offspring was minimised by emphasising the importance of conception 'in the heart', and thus the value of marriage, and conjugal intimacy, above biological relatedness (Ragone 1994). Other key early findings focussed on how ideas about biological reproduction change when it is assisted technologically: how conception can be 'renaturalized' after fertilization has taken place in a petri dish in a laboratory, and thus considered to be identical to conception *in vivo* (Strathern 1992). For example, the idiom of 'giving nature a helping hand' is often used to mitigate the novelty of assisted conception by implying that the role of technology is only supplementary to an underlying natural purpose. This finding – that the roles of biology and technology could be so seamlessly conjoined, readjusted, and even inverted - directly contradicted earlier models of kinship based on a strict separation between nature and culture (Levi Strauss 1969), a set of functional biological requirements determining the social order (Fortes 1969), a fixed biological 'programme' to reproduction (Fox 1997) or an overarching 'cultural system' for which biology acted as a fixed precursor (Schneider 1968). Although according to both law and social convention (or some would say nature) a biological, or blood, relationship is a fixed and unalterable one, a consistent and influential finding of early ethnographic studies of ART during the 1990s proved the opposite – that the process of defining kinship in the context of reproductive biomedicine was highly flexible, adjustable, and strategic (Hayden 1995, Ragone 1994, Inhorn 1994, and see esp. Kahn 2000).

An even broader sociological conclusion is that bioscience and biomedicine have together rendered human biology a more relative condition, in part, paradoxically, through the effort to facilitate new biological relations (Franklin 2013). In other words, as technological assistance to reproduction has increased in the context of new reproductive technologies such as IVF, cultural understandings of the biological base, or source, of parenthood have been altered: post-IVF, popular models of the biological facts of sexual reproduction have become more contingent. Simply put, there are now at least two different models that co-exist, and can be recombined. In one, nature (or biology) is imagined to operate independently, or even automatically – as the term 'spontaneous' conception suggests. In the other, it is the helping hand of technology that determines the course of biological action, enabling it to literally be reconstructed *in vitro*. The existence of a plural (as opposed to a singular) model of 'the facts of life' is one of the major legacies of the success of IVF, and one sociological interpretation of this shift is that human conception has been both de- and re-naturalised, with significant consequences not only for how reproduction is imagined to take place, but how it is actually practiced (Clarke 1998). The lived realities of this new conception model, in which biology and technology can be coupled together to make babies, have been researched extensively by ethnographers, such as Charis Thompson (2005),

who have documented how formerly given, or fixed, ties established through shared reproductive substance are constantly being redefined, renamed, and readjusted in the context of assisted conception. For example if a couple is using donor gametes, they may simply decrease their emphasis on this aspect of treatment (and the biological relation to the donor such an arrangement involves), and re-emphasise another dimension of parenthood, such as the new room the couple have together prepared for the baby, which re-emphasises the strength of their shared desire to reproduce. This practice of 'adjusting the volume', as it were, on blood ties and biological relatedness (which Thompson calls 'strategic naturalization', 2005) helps to explain why the rise of ARTs has been accompanied by the loosening of ties between marriage, procreation and parenthood, and the increasing prominence of alternative family structures. The newly explicit practice of remaking, or 're-crafting', kinship (to which the rise of ARTs has contributed) has led to a much higher visibility of donor, step-, transnational, multi-parental, same-sex, cross-racial, and other non-traditional 'modern' or 'achieved' families. In turn, these same families have become symbolic resources in the affirmation of the role of technology in producing new reproductive choices and possibilities. Reproductive tourism (or 'cross-border reproductive care' Inhorn and Gurtin 2011), as well as 'Google babies', the 'Gayby boom', surrogate motherhood (Crockin, 2013 this volume) or the prospect of male pregnancy (Daly and Bewley, 2013, this volume), confirm the increasing prominence not only of new means of achieving parenthood, and alternative kinship structures, but also the appearance of a new category of fertility behaviours which are enabled through various forms of technological assistance. These forms of 'technologically achieved fertility' have become increasingly complex as they have become increasingly common: today human reproductive aspirations are aided not only by IVF, but the Internet, the airline industry, and many other high-tech components. Overall, the cumulative sociological picture post-IVF reveals a more explicitly flexible, technologically-assisted kinship system (Franklin 2012), in which 'alternative' parenthood structures are not only considered to be more acceptable, but comprise a new social norm (as evidenced by the American TV series Modern Family, whose storylines revolve around the interconnections between several unconventional households). In this new value system, the traditional nuclear ('biological') family has not so much been replaced, as repositioned. Thus, alongside older norms, such as the desire for biological offspring, now co-exist the new technologically-assisted norms of ICSI, gamete donation, reproductive tourism, international surrogacy, and Mumsnet.com. A sociological consequence of these changes is that the meaning of biological relatedness has itself been relativized: kinship identities and ties once imagined to be primarily and innately biological or natural are now routinely imagined and celebrated as technological achievements.

Reproduction Inside Out

This transformative process of reimagining biological reproduction technologically is not only fundamentally intertwined with, but is in many respects epitomised by, the rapid rise of IVF from the late-twentieth century onwards. As new possibilities of technologically-assisted reproduction began to expand more rapidly in the post-IVF era, corresponding social means of facilitating them also began to be established to ensure their improvement over time. Ethical, religious and social endorsements of these new technologies, as well as of altered models of family formation, and new definitions of 'achieved' kinship, conception and parenthood, were accompanied by the gradual legitimization and legalization of new reproductive technologies throughout the 1990s. The last three decades have seen a

globalization of this pattern of social legitimation, accompanied by the increasing expansion of ART services. Increasing use of technologically-assisted conception services has been accompanied by the rise of 'new kinships', such as those achieved through transnational adoption and same-sex parenthood, and by the increasing prominence of mixed or blended families. Increasingly, these new forms of kinship and parenthood, enabled by biomedical assistance, and supported by changing social conventions, are in turn reshaping institutions such as the family and marriage.

Over this same period, IVF technology has also continued to develop and change. Both the means of culturing embryos and the hormonal regimens for ovarian stimulation have evolved, as have the practices of embryo transfer and selection. New methods such as blastocyst transfer, vitrification, and chromosome screening have been introduced successfully. The alphabet soup of procedures linked to IVF, from ICSI to PGD, has continued to expand, while the introduction of time-lapse embryo imaging (Aparicio et al, 2013, this volume) offers a measure of IVF's increasing technical sophistication. Much more is known about what is required to produce single, healthy offspring (Braude, 2013, this volume), and IVF success rates have risen steadily, while also becoming annexed to fields such as human embryonic stem cell science (Trounson, 2013, this volume), which offer new sources of insights into early human development and the prospect of ever-greater reproductive control.

Another consequence of the steady improvement of IVF technology is how much more is now known about the extent to which IVF has introduced conditional biological adaptations, such as adjustments to the *in-vitro* environment. Like the social changes with which IVF can now be seen to be associated historically (some of which have been both rapid and unexpected), the biological changes associated with IVF (such as altered phenotypes, metabolic changes, and developmental adaptations) are now beginning to be studied in more depth (DeBaun et al 2003; Brison, 2013, this volume). Attention has increasingly focussed on the media-induced effects on early embryonic development, some of which have been identified as epigenetic mutations (Niemetz et al 2004), *de-novo* DNA methylation patterns (Li et al 2005), or simply characterised as 'epigenetic risks' (Rycke et al 2002). In the post-Dolly context of a much greater appreciation of the complex pathways that define the fate of early developing mammalian cells (Bruce, 2013, this volume), and with ever more precise models of parental imprinting and epigenetic marking to hand (Torres-Padilla, this volume), it is to be expected that the biological effects of culturing embryos *in vitro* will soon be better characterised (Mann and Denomme, 2013; Watson and Padmanabhan, 2013 both this volume). That some of these effects, such as the increased incidence of Beckwith-Wiedemann syndrome in IVF offspring (Vermeiden 2013), have become more visible as the scale of IVF has increased is a pattern that is likely to continue, since small effects and rare results will be amplified by the effects of scale. The fact that some epigenetic mutations are heritable (Watson and Padmanabhan, 2013 this volume) will likely increase the importance of basic research into the effects of culture media on developing human embryos, and may eventually necessitate greater clarity about the ingredients of proprietary media (Brison, 2013, this volume).

Such changes suggest that the increased use of IVF and other ARTs has not only contributed to the reshaping of parenthood and kinship structures, or the institutions of marriage and the family, but also to the very development of the early human embryo, thus comprising a potentially new source of biosocial change, or evolution. Indeed, IVF may become an increasingly important context of cooperation between the social and biological sciences precisely because it has changed not only the social organization of human reproduction, but its biological mechanisms as well. In sum, one way to

describe what has happened to human reproduction in the wake of IVF is that it has been altered both inside and out. As noted above, IVF is linked to a shift away from a biologically-based discourse of kin-relatedness, and a loosening of the normative conventions supporting the traditional nuclear family. It now appears that during this same period, human reproductive biology - and by implication fertility -has also been changed 'on the inside', through modifications to human reproductive substance acquired through the process of assisted conception. Since the changes to embryonic development induced by the culture media are technically 'man-made', we have come full circle: the sociologist's counter-intuitive proposal that reproductive biology does not work 'automatically' or 'by itself', but is instead, at least in part, socially activated, or even 'socially constructed', may turn out to have its proof in the Petri dish after all!

It is this combination of newly flexible means of organising human reproduction externally, through looser social structures and new types of biological parenthood (e.g. egg donation, gestational surrogacy, etc.), with new types of internal reorganisation – congenital, metabolic and epigenetic –as a result of the *in-vitro* culture environment, that will await a more comprehensive biosocial evaluation in the years to come. In the meantime, what we can conclude at a general level is that IVF technology has contributed to a fundamental transformation of both the social and biological dimensions of human reproduction, as well as the way these two dimensions interact.

The Demand for IVF

These combined changes to the basic biosocial mechanisms of human reproduction, and the uncertainties they raise, have acquired greater significance as the scale of IVF continues to escalate both within and outside of Europe. However, it is likely to be within Europe that many of these changes will be most amenable to further characterisation, given both the concentration of scientific expertise in this region and the comparatively highly regulated ART industry. Most of the estimated five million IVF babies born by 2008 were born in Europe, where, according to the ESHRE statistics for that year, approximately half the world's ART cycles were conducted (ESHRE 2012). With more than half a million ART cycles per annum in Europe by 2008, Europe is home to one of the world's leading IVF markets, and the destination for an increasingly large number of IVF consumers. European IVF clinics are now serving a new generation of IVF consumers for whom the option of IVF has become more routine, and the purchase of reproductive services part of a well established market in (largely private) healthcare. Commenting on this new generation of IVF consumers, Norwegian IVF consultant Arne Sunde noted in a recent presentation that 'IVF patients are changing, and our conversations with these patients are changing', adding that 'they are more organised, more knowledgeable, more determined, and more assertive' (Sunde 2012). As social scientists such as Gay Becker have similarly emphasised (2000), the IVF sector is, among other things, a highly specialised service industry in an increasingly competitive market – and is thus linked to novel forms of consumer behaviour. For example, as Becker observed in her American study of IVF consumers, the Unique Selling Point (USP) of IVF is not a conventional product, but rather something many people take for granted, and even consider to be a basic human right, namely having children. One result of this unusual market, as business administration scholar Debora Spar has also noted (2006), is that IVF consumers have become increasingly forceful

about the nature and quality of the services they purchase, while also becoming increasingly angry they have to pay for them at all. Consequently, as Becker notes, IVF consumers (and practitioners) increasingly see themselves as social advocates, or even activists, who are not only lobbying for better healthcare for themselves, but human rights for all. As Becker notes, one of the main drivers of the IVF market is the need felt by many couples to 'do something' in order to get pregnant, and this now includes becoming more discriminating purchasers of IVF services. She describes the quest undertaken by many couples for successful fertility treatment as both a new social movement and a form of identity politics, both of which become forms of reproductive 'activism' as well as consumer rights movements (2000: p.102). Sociologically, both Becker's and Sunde's descriptions of IVF consumers, like those of Spar, correspond to emergent forms of twenty-first century health activism, known as 'biological citizenship' (Petryna 2002), or 'genetic citizenship' (Rapp and Ginsburg 2001), both of which have become increasingly visible in the context of contemporary biomedicine.

A predictable, and increasingly familiar, consequence of this newly activist generation of IVF consumers is that clinicians are encountering a more forcefully demanding and well informed type of patient, with whom, as Sunde points out, different kinds of conversations are being conducted. Another consequence is the shift he describes of IVF moving from 'Plan B' to 'Plan A'. Although it is difficult to acquire data that is other than anecdotal about the effect IVF may be having on people's perceptions of the best way to become pregnant, many of the qualitative studies by Becker and others suggest that a successful pregnancy is now much more widely perceived as something that has to be achieved, or enhanced, through technology. There are other reasons why IVF may be becoming Plan A instead of Plan B, such as increasing awareness of the effects of maternal age on the viability of oocytes (Gosden, 2013, this volume), or the 'straight to IVF' syndrome for women in their mid- to late-30s (Daly and Bewley, 2013, this volume). Again, what such a shift would suggest, if it is indeed occurring (which may only be for a small minority of patients), is that the difference between assisted and unassisted conception is no longer binary, but has instead become a continuum. It may be that a useful way to reframe Sunde's observation is simply to note that as IVF has become an increasingly dominant frame of reference for the purchase and consumption of fertility services, so too has it come to play a larger and more influential role as a twenty-first century model that has helped to reshape what 'planned parenthood' and 'control of fertility' mean to the general public.

Conclusion

On the basis of the above discussion we can reach a number of conclusions that, although speculative, are consistent with an increasingly large and diverse body of qualitative data indicating that assisted and unassisted reproduction now more closely resemble one another than they did when IVF was first introduced. Thus, for example, whereas IVF was once modelled on natural, or 'spontaneous', conception, the reverse is now increasingly common – that unassisted pregnancy is understood by analogy to IVF. If this is the case (and further research into this question is needed), it would have a number of important consequences for our understandings of IVF and ARTs, as well as for human reproduction, in what has been called 'the age of biological control'(Wilmut et al 2000). Among other things, such a shift would confirm an inversion of the original logic of IVF, namely that IVF and other ARTs were simply giving nature a helping hand. Today it is clear that IVF offers much more than this,

for it has enabled whole new understandings of the biological events it was imagined to replicate, in turn allowing reproductive cells to be reprogrammed and remade in the context of stem cell science, cloning, and regenerative medicine. These new, IVF-dependent, models of biological capacity are, moreover, artifactual: they depend on technological conditions to exist. In no small part they epitomise what biomedical technologies are imagined to be for, in the sense that they represent the scientific pursuit of new technologies intended to alleviate human suffering.

If the effort to establish a natural pregnancy increasingly resembles the IVF quest, as opposed to being considered an all but automatic biological process, it would confirm the findings of the now very large ethnographic literature on IVF indicating that there is a two-way traffic between these two spheres of reproductive aspiration, and that IVF is changing the meanings of 'spontaneous' pregnancy rather than simply assisting conception technologically. Indeed, there is an increasingly strong sense from the sociological and anthropological literature that this is exactly what is happening, as suggested by the observations of clinicians such as Sunde. Increasingly, it would appear, 'natural' biological parenthood is coming to be perceived more like IVF – as something that is in need of being managed, assisted, monitored (see for example, Lo, 2013; Beim et al., 2013; Lucas et al., 2013; all this volume), and as a process associated with a high risk of failure. Since much of the qualitative data on IVF, including that from the very earliest sociological studies of IVF consumers in the 1980s, confirms that knowledge of its high failure rate is not necessarily a deterrent to pursuing this procedure (Crowe 1985, 1990, Koch 1989, Williams 1988), another question that arises in the context of the very rapid worldwide expansion of ART technology is what exactly IVF is reproducing. What are people after when they embark on the pursuit of IVF? As noted above, Becker (2000) refers to the pursuit of IVF as a new form of identity formation, and there is ample evidence to support this claim from other studies (Franklin 1997, Inhorn 1994, Paxson 2004, Throsby 2004, Thompson 2005). Sociologically, this also makes sense. While clearly a good in themselves, children are also social goods. The reasons would-be parents want children may include what children bring in the form of social returns and conformity with social norms. For many couples, who cannot have children, there are high social penalties. Even if they are not explicitly pressured to have children, they may feel excluded, alienated or diminished by their childlessness. Separating out each of the factors that motivates people to want to reproduce biologically, to establish a viable pregnancy, and to have children is even harder than disentangling the proverbial baby from its bathwater. And what is notable is how many of the 'goods' associated with having children can be had through IVF, *even if it does not succeed*. For example, the pursuit of IVF offers the possibility of becoming aligned with a parenthood trajectory, and with a 'trying for a baby' identity, as well as the goal of future happiness that parenthood traditionally represents, thus offsetting the sense of exclusion from parenting conversations and aspirations, and thereby alleviating, if not entirely resolving, this problem. Now that IVF is less stigmatised, and indeed is often described as having become routine, the pursuit of IVF offers a newly valid social role as a would-be parent, an active consumer, and a 'trier' as opposed to a 'do nothing'. As a new social norm, IVF offers what the social theorist Sara Ahmed (2010) describes as 'the promise of happiness' – a way forward that is aligned with a future good, and acquires value through this association, even if it never attains its goal. Above all, the pursuit of ARTs offers a path forward that is sustained by hope, and offers proof of a commitment to a normative aspiration, even if it never delivers on its promise.

In closing, as a reflection on these conclusions, a final practical note concerns the future of reproduction, and the ways it has been changed by the advent of IVF and ARTs. If it is the case that the widespread popularity of these technologies has not only led to a remaking of kinship, but to new understandings of reproductive biology, and consequently to the remaking of reproduction inside and out, then a crucial priority for the future will be to improve documentation of, and thus ability to study, both of these important transformations. If the hoped for future of human reproduction is to be one that includes greater control over fertility, pregnancy, and fetal and child health, then it will be essential to characterise the effects of IVF and ARTs, both inside and outside the womb. Without adequate information, and in the absence of accurate documentation, the great ongoing experiment that has resulted from the transfer of IVF 'into man' cannot be properly evaluated. It was no small step for a woman to become pregnant using IVF, and we cannot evaluate what kind of step it was for either women- or man-kind to have accomplished this iconic technological feat unless we can more accurately measure and assess its legacy. The great experiment of human ART can neither be controlled nor interpreted in the absence of the insight and discipline that only basic scientific research can provide - including basic social scientific research. Ultimately the effort to characterise IVF and ARTs will depend on the successful integration of a diverse range of approaches from across the disciplines, including all of the arts and sciences. If the whole point of IVF is in order to facilitate successful human reproduction, then the effort to understand how human reproduction is being changed by the very technologies that enable this bridge to be built must be strengthened. Otherwise, the greatest paradox of IVF and ARTs could be that their rapid expansion could exacerbate the very difficulties they are intended to relieve.

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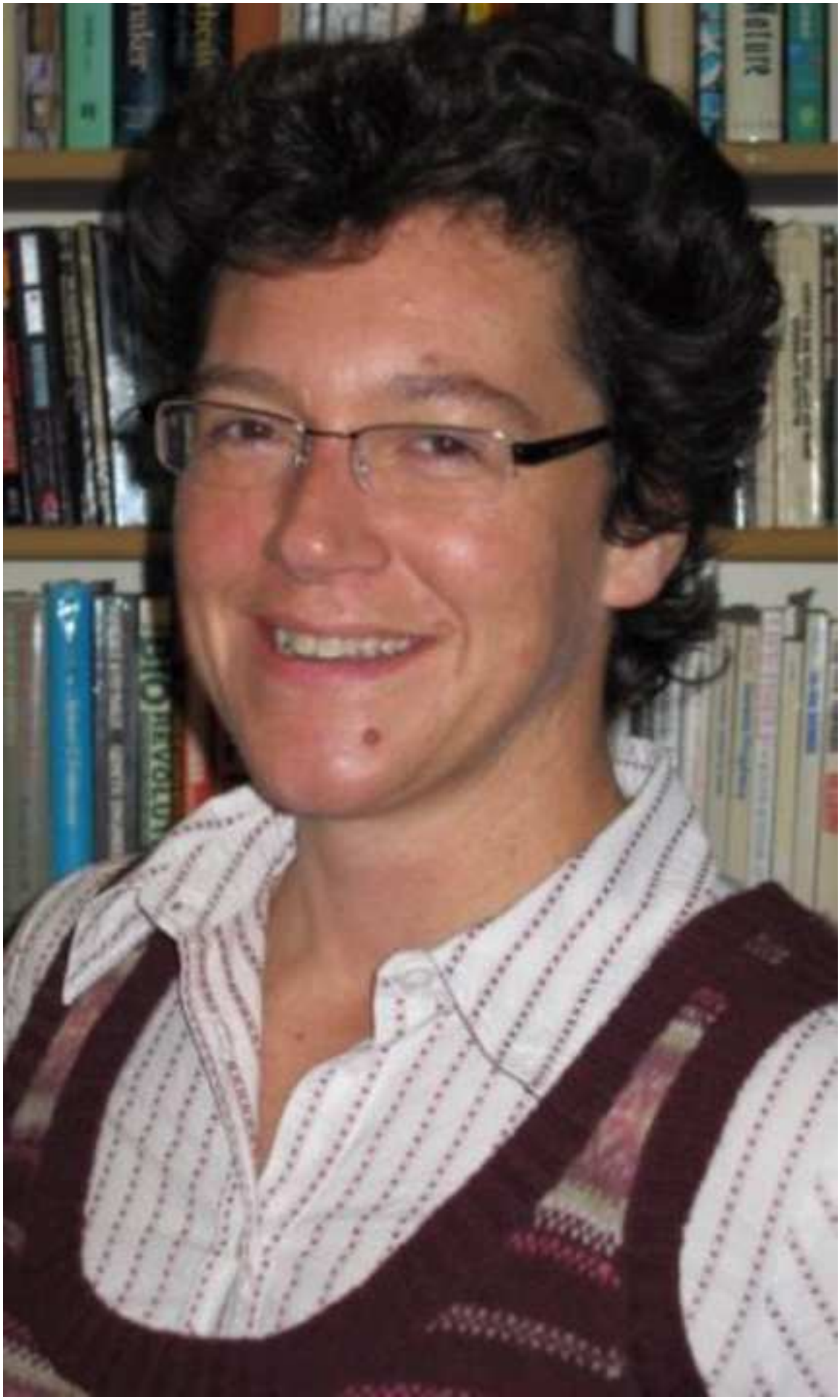

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