

## **Title: Can evolutionary thinking shed light on gender diversity?**

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### **Biographies**

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## **Abstract**

In two previous articles we argued that evolutionary thinking can contribute much to psychiatry. In this article we examine whether this is the case with regard to gender diversity. Issues of sexual reproduction lie at the core of evolutionary thinking, which often places an emphasis on how individuals attempt to maximise the number of successful offspring that they can produce. At first sight, it may therefore appear that individuals who opt for gender-affirming medical interventions are acting in ways that are evolutionarily disadvantageous. In spite of this, there are persuasive hypotheses that might make sense of such choices in evolutionary terms and here we explore these.

The development of self-conscious gender identification in humans may usefully be illuminated by an evolutionary perspective to some degree, but there is much about this complex and varied phenomenon that transcends our evolutionary heritage. It is therefore premature to claim knowledge of the extent to which evolutionary arguments can usefully be applied to issues of gender identity, although worth reflecting on the extent to which nature tends towards diversity in matters of sex and gender. The importance of acknowledging and respecting different views in this domain, as well as recognising both the uncertainty and likely multiplicity of causal pathways, has implications for clinicians. We make some suggestions about how clinicians might best respond when faced with requests from patients in this area.

## **Learning objectives**

- Understand evolutionary arguments about diversity in human gender identity
- Identify strengths and weaknesses in evolutionary arguments applied to transgender issues
- Appreciate the range and diversity of gender experience and gender expression amongst people who present to specialist gender services, as well as the likely complexities of their reasons for requesting medical intervention.

## **Declaration of interest**

The authors are members of the evo-psychotherapy study group at the Tavistock Clinic. The aim of the group is to promote evolutionary thinking in psychotherapy and psychiatry.

## **Introduction**

In our first article (Swanepoel 2016) we argued that the traditional disease model, still dominant in psychiatry, is less than ideal for making sense of a range of psychological issues such as the effects of early childhood experiences on development. We maintained that a model based on evolutionary thinking can deepen understanding

and aid clinical practice by showing how behaviours, bodily responses and psychological beliefs frequently develop for ‘adaptive’ reasons, even when these ways of being might on first appearance seem pathological. In our second article (Swanepoel 2017) we argued that current debates about Attention Deficit Hyperactivity Disorder (ADHD) can be considered afresh using an evolutionary lens. We showed how the symptoms of ADHD can often be considered adaptive to their specific environment and suggested that ADHD symptoms might frequently be understood best as a result of an ‘evolutionary mismatch’, in which current environmental demands do not fit with what evolution has prepared us to cope with.

In this article we examine whether such evolutionary thinking can help illuminate thinking about gender diversity and transgender experience. ‘Gender diversity’ here is used to mean a gender identification outside the conventional binary gender categories of ‘male’ or ‘female’, where both terms have typically been presumed to apply exclusively and unfalteringly from conception to death. Gender diversity is a topic that generates strong feelings and often polarised views. Claims to certainty about origins and management are common, despite the empirical basis of such claims often being very limited. Arguments over the cause, meaning, stability and significance of these ways of feelings are engaged with in deeply anxious ways in our changing society, especially given that we are nowadays equipped with the technologies to make significant bodily interventions. In the contentious public debate there are many matters of substance to argue over: the safety of interventions, treatment outcomes, autonomy in treatment decisions, the psychological cost of rigid patriarchal gender categorisation and norms on developing subjectivity vs the benefits of erasing or blurring all such categorisations. There are also broader epistemological questions that at times can derail debates: questions about what kinds of knowledge should be respected, and in what contexts, carrying what authority at the expense of which other forms of understanding (Wren 2019). Given this context, it may seem foolish to propose that it is worth considering gender diversity from an evolutionary perspective – especially as an evolutionary viewpoint itself often evokes strong feelings for or against.

Our intention is not to try and propose an overarching evolutionary framework for gender diversity, nor to supplant other emerging ways of understanding unconventionally gendered lives. Instead, it is to offer some provisional hypotheses of how evolutionary processes might play at least a part in determining an individual’s sense of their own gender, and hence add to an understanding of this increasingly manifest aspect of human experience. We also hope that inviting people, including clinicians, to consider such a perspective might contribute to reducing the stigma and discrimination that has often been associated with transgender identities, and to lowering the temperature in often polarised debates.

It seems reasonable to assume that evolutionary thinking is of relevance to these matters, since issues to do with sex and procreation (and leaving enough offspring) lie at the heart of evolutionary biology. At the same time, the actions of some trans people may seem to be inconsistent with traditional evolutionary theory, whereby each of us strives to maximise the number of healthy, reproductively capable offspring or other relatives that we leave in succeeding generations – sometimes termed reproductive fitness. Whilst we need to resist the conflation of sex and gender, and the incorrect assumption that gender identity can be equated with sexual identity and sexual behaviours, it is certainly true that, from an evolutionary perspective, what appears to need an explanation is that some transgender people (although not all)

make life choices that are likely to reduce their individual reproductive success. These include the choice to reject a life in the birth-assigned sex and gender role and instead to opt for a life lived in a different (or no) gender, and in many cases taking sex hormones and accessing surgery that may reduce or nullify their conventional capacity to reproduce biologically – even though new medical technologies, such as gamete storage with subsequent IVF or artificial fertilisation, may nowadays be able to counteract such consequences.

In this article, we will try to question such a limited picture of transgender lives through an evolutionary lens that will take into account both sexual selection and social selection, as well as social evolution. Box 1 gives definitions of the main terms we use.

### **What is gender diversity?**

It is often assumed to be a foundational condition of animal life that there are two types of sexed bodies and therefore two ways of being in the body: male or female. Across the whole of biology, this assumption in fact has little substance. In an encyclopaedic review of sex/gender expression across species, Roughgarden (2013), a distinguished evolutionary scholar and herself a transwoman, presents a compendium of information on sex and gender diversity in the natural world. Drawing on evidence from fish, birds, primates and other mammals she challenges the following common assumptions (among others): that an organism is solely male or female for life; that sex is only for reproduction, not pleasure; that females, not males, give birth; that males have XY chromosomes and females XX chromosomes; that males and females look different from each other; that compared to males, females prefer monogamy.

While all this evidence about the impressive amount of variety amongst many animals in chromosomal sex, mating behaviour and so on is suggestive, it is not clear what it teaches us about gender identity. Whether congruent with one's sexed body or incongruent, gender identity is a conscious feeling, a sense of self, and it seems very likely that it is a feature of human experience only (or perhaps of a very small number of other species if they can be said to have an identity at all, in terms of having an awareness of their place in the order of things). If individuals of non-human species do show behaviours that are more strongly associated with the other sex, this is unlikely to serve ends remotely comparable to human transgender behaviours. Yet while we should be cautious about reading too much from non-humans (e.g. fish that routinely change sex depending on their age or social circumstances), it can be salutary to remember that nature is not as binary as is often imagined, in relation to the sex of bodies, to sex roles and to sexual behaviours.

Among human beings, there is thought to be a 1.7% incidence of intersex classifications, where a person's sexual anatomy (e.g. reproductive organs) does not definitively fit the binary male/female pattern (Fausto-Sterling 2000) – a figure based on a 50-year review of medical literature, though this figure itself is controversial with some conservative commentators arriving at a much lower figure. Nonetheless, very many societies have devised ways of identifying the sexes according to visible bodily signs and creating very different social arrangements for each sex. This is the process by which we treat male and female people as distinctive with respect to a host of psychological and behavioural characteristics: the process of 'gendering'. Yet there is little evidence, across many eras and cultural contexts, that a settled and non-

conflicted cisgender identity is for many anything other than a concession to normativity in social contexts where rigid sexual differences are enforced. Thus, it is possible to see conventional gender not as an inevitable outcome of the biological differences between males and females, but as a complex developmental achievement and, at least in part, as a social construction.

Diverse gender identities have been documented across many different societies and historical time. These include the hijras of India (who are estimated to number around a million), two spirit people in some native American tribes, the mahu in Polynesia, some of the eunuchs of the ancient Roman empire, and the mukhannutan in early Islam. The literature on the subject (e.g. Nanda 2014; Reddy 2010) illustrates how diverse such atypical gender identities are in themselves, quite aside from the distinctions between them and the more familiar binary classifications of gender. The roles and behaviours of such people may include, for example, carrying out rituals, having a priestly or prophetic function within their societies, with a status ranging from outcasts to a high degree of respect and responsibility, while symbolic or actual surgical alteration of the genitals may or may not be practised (Roughgarden, 2013). Sometimes such variation may exist within a single cultural group of gender diverse people, including the Indian hijras, suggesting that simplistic formulations of what transgender identity is ‘really’ about, especially if framed in terms of conservative Western assumptions about normality in relation to gender and sexuality, are unlikely to be of much value.

Nowadays, more and more people are challenging the rigid articulation of sex/gender prescribed by culture and voicing an incongruity with their registered sex as inscribed on their bodies in the form of chromosomes, hormones and sex characteristics. For people with gender dysphoria, as for cisgender people, their gender identity is not felt as something chosen, but as a primary feature of who they are. Many experience a conviction very early in life that they have been born into the wrong sex/gender despite strong peer, family and social pressure to conform and often in the face of intense social discrimination. See Box 2 for an example. While some feel their gender identity to be a deep expression of a core ‘true’ self that is far removed from a simple preference for the typical activities, colours and clothes socially associated with the other sex, other gender diverse people question all conventional relations between sex, gender and sexuality in favour of a recognition of fluid lives, identities and practices. Many contemplate making alterations to the non-anomalous body to achieve what they hope will be a more coherent sense of self. Internationally, a meta-analytical study reported that the population rate for ‘transsexualism’ was 4.6 in 100,000 individuals: 6.8 for trans women and 2.6 for trans men; time analysis found an increase in reported frequencies over the last 50 years (Arcelus 2015). However, these figures are mainly based on individuals attending clinical services – and within those services, only those who were clearly diagnosable as ‘transsexual’ – and so do not provide an overall picture of the proportion of gender diverse people in the general population.

While the DSM 5 (APA, 2013) diagnosis of gender dysphoria (classified in the ‘mental illness’ category) is widely used by and about transgender people, increasingly in Western societies gender diversity is no longer seen as a pathological ‘disorder’. Many trans and gender diverse people function extremely well. Yet for those presenting to adult gender clinics there is also an association with considerable psychological distress and difficulties such as anxiety and depression (Heylens 2014).

There also appear to be higher rates of co-occurring autistic traits in people with gender dysphoria relative to the general population, in young people (De Vries 2014) and adults (Jones 2012). Despite these rates of psychological atypicality and distress (and the ongoing risk to trans people of stigmatisation, harassment and minority stress), there is emerging evidence of the positive change associated in the long term with successful transition and medical intervention (see Dhejne 2016). Significantly, amongst adults receiving physical interventions (sex hormones and surgery), there is a low level of reported regret or wish to re-transition, although long-term data suggest some evidence of suicidality and self-harm *after* transition (Asscheman 2011), although the reasons for this are multifaceted and complex.

There has been a significant increase in the numbers of young people referred to child gender clinics in recent years (Butler 2018). There is also, internationally, a changing assigned male/assigned female ratio (Aitken 2015), with an increase in the proportion of birth-assigned females relative to birth-assigned males, especially amongst 14-17 year-olds. Studies tracking a group of initially well-functioning and well-supported older teens who received medical intervention to help them transition show a picture of good psychosocial functioning (De Vries 2014). A later-presenting more troubled group of teens has been shown to make fewer psychosocial gains after physical intervention (Kaltiala-Heino 2015). It is sometimes hard to establish whether the psychological troubles young gender diverse people may face emerge as a result of the continuing social disapprobation and the impact of bullying, social isolation and a lack of effective family support or because of the incongruity they experience between body and felt gender.

Studies are beginning to reveal the range of identities, gender expressions and self-descriptions trans people employ, although there is no agreement in the clinical or academic literature on a typology. Diversity of presentation is characterised by such features as age and/or developmental stage when first questioning gender, the intensity and urgency of the desire to make a social transition and bodily changes, the fixed or fluid nature of the identification, the sense of a binary or non-binary gender identity, the level of associated psychosocial difficulties and so on. Gender pathways may vary considerably between birth-assigned females and birth-assigned males. The relationship between gender identity, sexual attraction and sexual behaviour is also varied and complex: trans people may be sexually and/or romantically drawn to any gender. These data point to the likelihood of different underlying factors and motivations. It is quite likely that some pathways have a biological component and, although it is too early to be sure, there may be a genetic element within this. As the degree of social acceptability and social protection of some trans people is increasing in the West under such legislation as the UK Equalities Act, 2010, (although less so for non-binary people), the prevalence of gender dysphoria is increasing, with more people coming forward as gender questioning in childhood and adolescence and contemplating a greater range of options with respect to identity and presentation (Twist & De Graaf 2018).

### **Evolutionary arguments about sex, sexual behaviour and gender identity**

Ever since Darwin, it has been appreciated that the key to evolutionary success is for organisms, via their inherited material (their genes in today's parlance), to leave at least partial copies of themselves in future generations. For the great majority of

individuals, this consists of leaving direct descendants, although in some species, for example the social insects, individuals reproduce ‘vicariously’, via close relatives – such as the queen(s) in an ant, bee or wasp colony (Alcock 2013). Evolutionary biologists, whether concerned with humans or other species, tend therefore to assume that any feature of an organism’s life, including its sexual behaviour, is likely ultimately to have as its end the production of offspring to whom the individual in question is related.

Arguments in favour of this view reached a climax in the 1970s and 1980s with the publication of Dawkins’ *The Selfish Gene* (1976) and Wilson’s *Sociobiology: The New Synthesis* (1975). What such books attempted to do was to argue that virtually everything of interest about human behaviour was the result of the same evolutionary forces that have shaped the behaviour of other organisms, especially in our closest evolutionary relatives – other mammals, particularly the other great apes.

However, many anthropologists and sociologists, unconvinced by what they saw as a reductionist and partial account of humanity, hit back with a series of powerful critiques (see for example, Sahlins 1977). In turn, defenders of evolutionary biology responded with more nuanced arguments and detailed evidence from humans, other primates and mammals, and a number of other sexually reproducing species, to show how wide a range of behaviour could contribute indirectly to reproductive success (for a recent overview see Alcock 2013).

Whilst taking care not to conflate homosexuality and gender atypicality, recent debates around possible evolutionary underpinnings of same-sex sexuality may be illuminating, as this also seems to require explanation from an evolutionary perspective. We know that homosexuality has also existed throughout history and in all known cultures where adequate data exist, despite occasional protestations to the contrary. It is however likely that exclusive homosexuality is statistically quite rare, with evidence that female sexuality can be quite fluid across the lifespan (Diamond 2009). Besides, gay men and lesbian women are parents of more children than is sometimes supposed (e.g. Bridget 2003).

Research in the 1990s suggested that a tendency towards same-sex sexual attraction and behaviour might have a biological basis, namely differences in brain structure (LeVay 1991), and a debate began that continues to this day about whether sexual orientation might be heritable to some degree (e.g. Bancroft 1994) – as well as a debate about the motivation behind such scientific investigations. Part of what gives this debate such intensity is the fact that the search for causes always risks being oppressive, threatening to undermine the autonomy and social status of the person whose life is being explained. It can seem that to look for explanations of why sex/gender minority experiences occur requires not only that they be understood, but that they be open to prevention or suppression (Corbett 2009).

Gavrilets and Rice (2006) developed a theoretical model of the likely architecture of genes that might influence human homosexuality that predicted that individuals exhibiting both same-sex and ‘opposite-sex’ sexual behaviours should be common.

Several credible adaptive hypotheses for same-sex behaviour have been debated in the literature, positing the way that same-sex attraction may have wider benefits in terms of enhancing friendship and bonding, mutual assistance and social inclusion and diminishing intra-sexual aggression (Bailey & Zuk 2009; Kirkpatrick 2000) and might confer a reproductive advantage to relatives of gay people (McKnight 1997). Here, we

must be careful not to equivocate between the concepts of evolutionary value and social/psychological value or purpose. Zietsch (2008) has also shown indirect evidence that the genes that predispose towards homosexuality increase the mating success of *heterosexual* carriers of those genes, potentially explaining why non-heterosexuality remains relatively common.

### **What is the evidence for biological factors in the development of gender diversity?**

From a theoretical point of view, biological correlates of gender diversity might be expected to exist either simply at a genetic level or, more probably, in more complex gene-environment interactions. Indeed, some people hold that research on the genetics of gender identity has the potential to reduce stigma of trans and gender diverse individuals by highlighting the continuous, not dichotomous, nature of gender identity.

We stress that it seems virtually inconceivable that a trait as complicated as atypical gender identity will be found to be determined at a single locus, or even a small number of loci. The question is whether it is perhaps possible that interactions between many loci together with certain features of development, either pre-birth or in the first few years of life, govern gender diverse expression and behaviour. Studies have shown that most complex traits are multifactorial and polygenic, meaning that hundreds of loci, each with individually small effects, contribute additively to trait variance along with other non-genetic factors. So, we would hypothesize that gender identity is complex, multifactorial and polygenic, meaning that many genetic factors likely contribute to the development of gender identity through complex interactions with many environmental factors.

Under what is called the polygenic threshold model, contributing factors assume a continuous normal distribution in the population. In other words, while any two people may have very different phenotypes (e.g., gender identities), the entire population exists along a single spectrum with no clear divisions (e.g., no line between 'cis' and 'trans' identities). This is the model that has shifted our conceptualisation of traits like autistic spectrum conditions.

Indeed, it is increasingly realised that in humans there is a variety of ways that the two sex chromosomes may be expressed in different individuals. The way they interact with other genes on autosomal chromosomes as well as with the environment, and the range of different hormonal profiles that exist in both males and females, demonstrate that the process by which chromosomes shape the development of sex characteristics, mediated by hormones, is more complex and nuanced than a simple dimorphic model of the sexes would suggest (Reiss 2017; Hyde 2019).

Most of the evidence about the heritability of gender identity comes from studies of monozygotic (MZ) and dizygotic (DZ) twins – the rationale of such studies being that MZ twins, being genetically identical, share all genetic effects, while DZ twins share on average 50% of their additive and 25 % of the non-additive genetic effects. Genetic influences are indicated when the average within MZ pair similarity is larger than the average within DZ pair similarity. In a recent literature review, Polderman (2018) found 11 twin studies looking at gender identity, some in children, some in adults, or both. All studies bar one included birth-assigned females and birth-assigned males.



While these studies can seem and be powerful, the heritability of any given characteristic is not a fixed and absolute quality, as Bateson and Gluckman (2011) remind us. Its value depends on a number of factors, such as the particular population of individuals that has been sampled, the condition under which they are measured and, we would add, how they are measured. The way gender identity was ‘measured’ in some of these studies is not entirely convincing. Many run the risk of conflating a sustained transgender identity with nonconforming gender expression. Other studies used rather one-dimensional binary constructs of ‘masculinity’ and femininity’ that are deeply culturally embedded. (e.g. a play activities checklist or parent-reported judgement (from the CBCL) of whether the child ‘*behaves like opposite sex*’.)

Polderman (2018) found that heritability estimates across the 11 studies covered a wide range – from around 35% for MZ twin correlations, and half that for the DZ twins correlations. Some found similar figures for male and female assigned twins. Others found that heritability for masculinity was somewhat higher than for femininity. Many studies had wide confidence intervals. Overall, there appeared to be a negligible role for shared environmental factors and a small potential role for unique environmental factors. The authors of the review conclude that it is sensible to “hypothesize that gender identity is a multifactorial complex trait with a heritable polygenic component” (Polderman 2018 p. 95).

Giving just a flavour of other research, there is no evidence that genetic issues in the synthesis of steroid hormones (found in some intersex presentations) play a role in the prevalence of gender dysphoria (see Mueller 2017). The work of Hines (2016) suggests that if girls with congenital adrenal hyperplasia have ‘boy-like’ toy preferences, this is because they are less sensitive to socializing cues about what are considered to be gender-appropriate toy choices. Here we see nature determining not the choice itself but the girls’ response to nurture (see McCarthy 2016).

Temperament as a biologically-determined characteristic has also been examined in transgender children, with mean activity levels being more closely aligned with a child’s asserted gender identity than the child’s sex assigned at birth (Zucker & Bradley 1995).

By now, the idea of the brain as a unitary organ that is either ‘male’ or ‘female’ has been widely challenged, given that few features are found to be highly dimorphic. Some researchers do report on sex-related differences that seem robust and widespread (Cahill 2006), while others argue that much of the science is flawed and biased, and that whatever aspect of the brain that is measured – structure, connections, activity – there is much more overlap between male and female brains than differences (Joel 2015). Nonetheless, some studies looking at transgender individuals have shown that they may have certain brain structures more closely aligned to their *experienced* gender than their sex assigned at birth (Garcia-Falgueras & Swaab 2010). Postmortem studies have suggested this is the case for several types of nuclei, most notably the bed nucleus of the stria terminalis. In male-to-female transsexuals, the BSTc was similar in size to that of control women, whereas in the only female-to-male transsexual studied so far, the BSTc was similar in size to that of control men (Kruijver 2000; Zhou 1995). Our understanding of these patterns is complicated by a subsequent study which revealed that this sex difference in BSTc volume reaches significance only in adulthood (Chung, de Vries and Swaab 2002), despite the fact that feelings of being differently gendered are widely reported to begin in childhood.

Structural MRI studies (albeit, small and limited in scope) have found variously that the brains of trans individuals may resemble those of their birth-assigned sex, may correspond with those who share their gender identification or are intermediate to 'either sex' (see Mueller 2017). With new forms of imaging now allowing inferences about connectivity to be made, studies of transgender individuals reveal differences in white matter connectivity somewhere between controls of the participants' sex assigned at birth and cisgender individuals of their experienced gender (Kreukels & Guillamon 2016).

So, we can tentatively conclude that the role of biological factors in the development of gender diversity is still unclear and research in this area is both fluid and changing quite rapidly. While there is as yet no clear biological marker associated with being transgender, the evidence regarding twin studies, brain differences and temperament does not rule out a genetic component to gender diversity, which would align with what we know about many other human variations that appear to be the result of complex nature-nurture interactions. We admit that space precludes us from providing a detailed review here. Nevertheless, to account for a strongly-felt, unwilled, human capability like gender dysphoria, we probably need multiple level explanations where the social and the biological intersect. That is, we may expect eventually to find, for at least a subsection of transgender people, that gender identity is predisposed genetically while also biologically enacted in the brain and enhanced or suppressed by cultural pressures and individual choices. Of course, a problem with identifying a putative genetic marker is that some gender clinics might restrict their offer of physical interventions to those gender diverse people who can be shown to have the requisite biological marker.

### **What might be the evolutionary basis of gender diversity?**

If gender diversity entails, for at least some trans people, a reduction in their chances of procreation, and if it does have a genetic component, it suggests that it must be biologically adaptive in some way (either on its own or because of association with some other fitness-enhancing trait) since it has persisted over such long periods of time and in so many social environments. We write 'suggests' because biologically non-advantageous traits can exist; for example, evolution always lags behind changes in the environment and there can be local adapted genomes that get disrupted with shifts in space. Nevertheless, such considerations usually apply to relatively minor features of an organisms' anatomy or behaviour (such as camouflage or a preference for one physical environment over another) not to such major features as reducing the chances of leaving progeny behind. So, the question we ask here is whether there might be selective forces that could lead to gender diversity and its persistence.

While transgender people who make choices for reproductive surgery cannot, through conventional sexual intercourse, have their own genetic children post-intervention, we have no evidence that they actually have reduced reproductive rates, given that they may have become parents prior to accessing this intervention, or they may, these days, have recourse to in-vitro fertilisation, artificial insemination or other technologies using their own genetic material. Besides, as we briefly saw with research on same-sex sexuality, and as most of us know, the purpose of sex and mating behaviour is not only reproduction.

Indeed, this is one of the standard critiques of crude evolutionary thinking – that it seeks to reduce everything about human behaviour, whether our sexual behaviour, our interest in music, our capacity to tell stories, our tendency to believe in the transcendent, the way that many of us seek for purpose and value in our lives, to questions about survival rates and the number of offspring one has. This, of course, is to employ evolutionary thinking as too blunt an instrument; human values can transcend evolutionary values, something that is perhaps seen with particular clarity when we consider certain unpleasant human behaviours that may have been favoured through evolution but which the majority of people reject. More specifically, the kind of sexual intimacy that transgender people, can seek may result in reproduction or it may serve other (social and psychological) ends, as does sexual behaviour for most humans – to achieve emotional intimacy, to repair rifts, to achieve sexual pleasure etc.

Another consideration is that while a cisgender history might seem to be optimal for reproductive success in a stable and unchanging environment, if the environment is unstable and undergoing alteration, it might be advantageous for some individuals not to be tied to the same genetic programme as the majority. In such a world, could genotypic diversity in a group of humans lead to greater stability? A question like this raises the possibility of ‘group selection’, in which it is argued that traits that are disadvantageous to individuals within groups may persist if they allow the groups to which such individuals belong to survive correspondingly longer than other groups.

Although such arguments are deeply controversial among evolutionary biologists, such a possibility could mean that value would be placed on a range of gender identities and a degree of versatility in forms of gender expression as a positive evolutionary strategy. This could mean that gender diverse-inclined cisgender people might be seen by some as more attractive mates. Women often do admire men who are not tied to conventional male gender norms, but seem warm and caring, expressive, good communicators. Similarly, males often admire women who are tough, brave, active and independent – against common social norms of what women should be. Perhaps these gender-nonconforming qualities in cisgender people can be thought of as signifying genetic superiority under certain conditions. A genetic basis to gender diversity would thus be part of our beneficial genetic variability. This argument assumes that historically trans people would have faced extinction but for their being bolstered by a corresponding advantage to the social groups to which they belong. This in turn implies that human populations hold a reservoir of the versions of the genes that contribute to gender diversity through an evolved capacity for flexibility in gender identity and adoption of the socially-sanctioned ‘gendered’ behaviour of the other sex.

Roughgarden (2013), meanwhile, proposes that in humans we should replace the entire notion of ‘sexual selection’ – mate choice based on the likelihood of reproductive success – with that of ‘social selection’. Social selection potentially offers an alternative to sexual selection as a general approach to mating behaviour and parental investment, emphasising the role of cooperation in reproductive activities, although competition is acknowledged too. Cooperation realised through teamwork is not altruism, and its evolution is consistent with, but does not require, kin/multilevel selection or other evolutionary processes that cause the evolution of traits that benefit the receiver but disadvantage the donor. It is hypothesised on this model that mutual direct benefits may be more important overall in explaining cooperative behaviour than altruism-based explanations.

## Social evolution

Another hypothesis for the historical and social pervasiveness of gender diversity is not a matter of biological evolution at all, but of social evolution. Cultural evolution is an evolutionary theory of social change. Originally developed in the 19th century by anthropologists stemming from Darwin's research on evolution, in the belief that social change resulted from biological adaptations, it is now more commonly accepted that social changes arise in consequence of a combination of social, evolutionary and biological influences. Adopting Richerson and Boyd's (2005) definition of culture as "information capable of affecting individuals' behavior that they acquire from other members of their species through teaching, imitation and other forms of social transmission", we can see cultural evolution as implying that in humans the mechanism of evolution has to a large extent transferred to the social or cultural level. Here, slower methods of variation and natural selection give way to speedier processes of acquiring and transferring information and ideas. If this is the case, then humans show characteristic patterns of behaviour which are *not* programmed by our genes but whose perseverance in our species have a certain utility, achieved through the mechanisms of learning and imitation. As McKnight (1997 p.125) writes, "if social evolution has a mechanical analogue to inheritance as its driving force, it is imitation".

Accordingly, it is imitation, alongside self-consciousness (which can itself be seen as a survival strategy), that has allowed for the creation of a valuable and in some way useful enhanced repertoire of sex/gender expression. In this light, we might see gender-diverse-inclined individuals as adapted, not to physical environmental demands, but to the *social* demands placed on them. This means that culture, as well as our personal histories, plays a big part in the pattern of our gendered behaviours and desires.

Within such a framework, one could see the category of gender dysphoria serving as an invitation to bring a set of feelings, beliefs, ideas and experiences into a particular form of coherence. We humans are makers of shared social meanings and we seek frameworks to help make sense of feelings such as social unease and bodily dissatisfaction. It is important to say that nothing is implied here about the genuinely compelling nature of a persistent and intensely-felt gender identification that has developed partly in this way. But it is possible that for some people, perhaps especially adolescents, there may be particular complex forces shaping the formation of an atypical gender identity, including forms of anxiety, social isolation and disgust at pubertal changes. Sensitive exploration may be required to assess the likelihood that it will settle and endure in its current form as the individual enters new settings and undergoes new experiences. This may be especially important at this time for young people assigned female at birth. See Box 3 for an example.

Our own view is that attempts to impose a binary between biological evolution on the one hand and social evolution on the other are unlikely to succeed. Indeed, there are a number of attempts to find ways in which the two may co-evolve (e.g. Richerson 2017; Whiten 2017). Whatever the relative importance of biological and social evolution, and the nature of the interactions between them, what is the case is that in our inter-connected age, where new ideas emerge and are replicated massively at great

speed, we are now seeing a generation of young people who are now almost routinely asking themselves if they are trans or differently gendered to explain their bodily alienation and discomfort and their resistance to cultural norms of male and female behaviour and heteronormative sexuality. If we consider the concept of 'fit' with the environment, we might see how some individuals with a predisposition to gender dysphoria (for whatever reason – genetic or social) may come to feel that they would be better matched with their environment if they were of a different gender. It may be hard to disentangle the elements that have led to such feelings, and to make ethically-sound clinical decisions based on them.

## **Conclusions**

In this paper we have considered a variety of evolutionary hypotheses based on the fact that gender diversity and its expressions have manifested themselves across different eras and cultures, and the possibility that both biological forces and social evolution may play a part. There seems to be a biological basis to at least some forms of gender diversity, and a possible genetic component within that. However, it is also likely that a genetic predisposition to gender diversity, if it exists, is probably only a precursor or tendency, not a determination, and this genetic pathway may only be present for some trans people. Where genetics does play a part, the phenotypic expression of any individual is also likely to be influenced greatly by social and other environmental factors. The causes of gender diversity may be so wide-ranging that we cannot easily tease out the relative contributions that various factors make. Much remains to be understood about the recent increase in the number of people seeking help from specialist clinics, and the preponderance of birth-assigned females being referred to adolescent services. Overall, the evidence suggests that there is no simple explanation for the various and multiple transgender identities, but that that biological and adaptational influence cannot be ruled out and that social/cultural factors also play a significant part.

Many transgender people lead rich and fruitful lives. However, it is possible that a small number of those presenting with a desire to medically transition may be doing so on the basis of beliefs and circumstances that are altered and modified over time, with the possible result that they later regret irreversible treatment. This therefore poses particular problems for those with clinical responsibilities in this area.

In the UK, it is important for clinicians to know that UK equality legislation (Equality Act 2010) makes discrimination based on gender illegal. Young gender diverse people are therefore legally allowed to choose by which pronoun (he/she/they/etc.) they are described and by which name they are addressed. They are also legally entitled to wear the school uniform of their identified gender and to not have to use the changing room facilities of their sex assigned at birth. This is an important piece of legislation that protects potentially marginalised people. However, ethical difficulties may arise in the context of children, who may not always have the capacity to understand the long-term consequences of the choices they make. In work with gender variant young people the task is to understand the complex ways in which they may present – often with significant associated difficulties – so as to help them to maximise their developmental opportunities and to tolerate the distress of the perceived mismatch of body and gender feelings, whilst exploring the possible pathways available to them (Di Ceglie 2018). This affirmative, but cautious, approach is not always well received by young people and families, who may see the problem as a simple biological

‘mistake’ that can be rectified by hormonal interventions and surgery. There can be a powerful pull to reduce complexity and simplify children’s experiences – a pull seen in many of the polarised stances from which these issues are often argued (Wren 2019).

Because of the uncertainty surrounding the science of gender diversity, in offering a range of suggestions about how evolutionary mechanisms might play a part in gender diversity, we encourage readers (as we do ourselves) to take a position of ‘informed uncertainty’ when seeing gender diverse clients, rather than feeling we should take a more clear-cut view of its origins and the appropriate care. What is most likely to lead to successful outcomes for clients, so far as current judgement allows, is sensitivity to and respect for each person’s lived experience, an open exploratory stance towards complex developmental pathways, an awareness of the relevant research and professional guidelines in considering options for care, and a commitment to best ethical practice with respect to issues of safeguarding and consent.

It may be that at least some of those who are differently gendered would feel less uncomfortable, distressed and shamed if society was not so fixated on essentialist notions of gender and gender identity and more accepting of the belief that the idea of a clear-cut sex and gender binary is a massive oversimplification. In this sense, a ‘queer’ society, one that was more accepting than is generally the case of gender diversity, would be better for the mental health of those with dysphoria and might even result in lower rates of requests among adolescents for physical interventions. This would seem to be desirable for a number of reasons, not least because physical interventions for young people can seem to constitute gender in a highly normative way (dependent on the visible identification with one unambiguous binary sex), because of ethical concerns about the impact of irreversible physical effects (including on fertility) being brought about in childhood and because of the associated health risks that come with exogenous hormones.

Perhaps we can imagine a time when an individual’s biological sex and their gender identity will be less apparent, more idiosyncratically honed, and of less interest in everyday social transactions (other than to intimates). The expectation that people’s bodies, gender feelings and gender expression should line up in the conventional way across the whole life-span may wane. Under these social conditions we may still see people choosing to undergo individually-tailored hormonal or surgical interventions, but we may also see more and more people simply enjoying the expansive social freedom to self-define in novel ways. Understanding and living with such new arrangements will raise ethical, political and legal questions alongside medical and evolutionary ones.

### **Box 1: Definitions of terms used in this article**

**Gender** A composite term referring both to one’s sense of self as male or female, and society’s perception of one’s sex and sex role. A person’s gender can be at odds with their assigned sex at birth as determined by genes and hormones.

**Sex** Traditionally understood as the categories of ‘female’ and ‘male’, into which humans and many other species are classified as a result of future potential reproductive functions – as determined by anatomy or other measurements (e.g. chromosomes, hormone levels).

**Gender identity** An individual's deeply-held personal sense of their own gender as male or female, neither or both.

**Sexual identity** An individual's conception of themselves in terms of those to whom the person is romantically and/or sexually attracted.

**Gender variance and gender diversity** Umbrella terms used to describe the wide range of gender identifications outside conventional gender categories.

**Transgender and trans** Terms to denote individuals who identify with a gender other than that associated with their birth sex.

**Non-binary** A term referring to people who do not identify with conventional maleness or femaleness.

**Gender dysphoria** A diagnosis in DSM5 (APA 2013), defined by strong persistent feelings of discontent with one's assigned gender and identification with another (or no) gender resulting in significant distress and impairment.

**Cisgender** Someone whose gender identity as a young person or adult matches the one they were assigned at birth.

### **Box 2: Case vignette**

*Billy is a five-year old child, assigned male at birth, who insists that his body is 'wrong' and he should have been born a girl. He is deeply unhappy with his body and has asked his mum to take him to the doctors to cut his willy off. Billy is at his happiest when he can wear a dress and be seen as a girl. He wants to be called Ellie. His parents don't know how to manage this and confirm that when Ellie wears a dress and is allowed to play with dolls and other girls, she is content and smiling. When they tell him that this is just a game and he is actually a boy, Billy becomes tearful and angry and says that his body is wrong and he wants it 'fixed'.*

### **Box 3: Case vignette**

*Bethany was sexually abused by her mother's partner when she was 12. She was raped by a stranger when she was 14. After this, she became suicidal and took an overdose. She was treated as an inpatient in a psychiatric hospital and during this time she came to the conclusion that she did not want to be a female and felt more comfortable identifying as male. She was tearful and anxious whenever she was addressed as Bethany. In contrast, when called by the preferred name of Liam and presenting as a boy, he felt a lot more settled and able to think about having a future outside of hospital.*

### **MCQs**

Select the single best option for each question stem

#### **1 An evolutionary approach to gender diversity:**

**a** is likely to provide us soon with a single unifying explanation

**b** depends on finding a causative gene or set of genes

**c** offers hypotheses that may explain why it appears across history and cultures

**d** should not take gene-environment interactions into account  
**e** must demonstrate that trans people have as many offspring on average as the general population.

**2 It is not true that:**

- a** there are some animal species where an individual's sex changes during its lifetime
- b** in some species adult males and females look very different, in others they look very similar
- c** some studies have found correlations between a person's brain structure and their sense of gender identity
- d** transitioning enables people who would not have been able to have children to have them
- e** twin studies indicate that cross-gender identification has a heritable component.

**3 In the UK transgender children require a professional opinion prior to which of the following changes?**

- a** attend a single sex school
- b** use the bathrooms of their chosen gender
- c** be addressed by their chosen (rather than given) name
- d** be referred to by the pronoun they choose
- e** genital/breast surgery.

**4 People with gender dysphoria**

- a** have all felt they were biologically in the wrong body since early childhood
- b** often say they want to change gender in order to seek attention
- c** all have additional undiagnosed psychological disorders
- d** may only have felt they were in the wrong body from adolescence
- e** have a form of autism.

**5 Gender diverse people**

- a** are asexual because of the treatments they have received
- b** typically self-define as homosexual
- c** may be romantically and sexually drawn to people of any sex or gender, or to none
- d** prefer not to have sexual partners
- e** typically self-define as heterosexual

Correct answers: 1c, 2d, 3e, 4d, 5c

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