Hormones, Sexual Behaviour, and Gender Identity in Human Development

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Abstract

In studies of human sexual behaviour, many complex factors are involved. Some are attributed principally to biological sources, others to social, cultural, and interpersonal human relations. This paper introduces some of the leading issues in contemporary research about the role of hormones in influencing sexuality in humans. It provides a comparative overview of biological and psychological ways of framing research questions pertaining to human sexual behavior. It contrasts male and female behaviors over the lifespan and includes discussion of issues associated with aging and sexual health. Further, it examines the concepts associated with sexual orientation, gender identity formation, and atypical forms of sexual differentiation in humans as they occur biologically and psychologically. The paper concludes with an introduction to the study of prenatal hormones and environmental endocrine disruptors, offering fresh evidence of the potential dangers to human reproductive health attributable to prenatal exposure of the human fetus to environmental estrogens such as diethylstilbestrol (DES).
Introduction: Purpose of this Study

This paper examines a number of significant factors associated with the psychology and biology of human sexual behaviour, sexual orientation and gender identity. It is an outgrowth of ongoing research about leading issues in contemporary studies of human sexual behaviour across the lifespan and is in response to calls for more research in the area of public health surrounding human sexuality and sexual behaviour (Coleman, 2002) and more studies of the individual and social consequences of sexual behaviour (Wagstaff, Abramson, & Pinkerton, 2000). It examines some key biological aspects of sexuality—particularly the role of sex hormones (also known as gonadal hormones) and their association with human sexual differentiation and behaviour—as well as the limitations of biologically-based research in explaining all aspects of human sexual behaviour and sexual development (DeLamater & Friedrich, 2002). It also reflects some of the important components of the psychology of human sexuality, particularly through an examination of studies that recommend more thorough approaches within the psychology community for understanding and assisting persons with sorting out of issues of sexual orientation, gender identity, and sexual dysfunction across the lifespan. Finally, this paper offers insight into the significance of research about prenatal exposure to exogenous gonadal hormones such as diethylstilbestrol (DES), which have been recognized as having the capacity to disrupt the normal workings of the human endocrine system and have been associated with atypical processes of human sexual differentiation, psychosexual development and gender identity formation (Hines, 1998; 1999).

In underscoring the importance of promoting sexual health across the lifespan, Coleman (2002, p. 4) draws to our attention work in 2000 of the Pan American Health
Organization Regional Office of the World Health Organization (WHO) in collaboration with the World Association for Sexology, in defining sex, sexuality, and sexual health. These topics provide an underpinning for the investigation of this current paper:

1. Sex: “Sex” refers to the sum of biological characteristics that define the spectrum of humans as females and males.

2. Sexuality: Sexuality refers to a core dimension of being human, which includes the individual and social capabilities and conditions for eroticism, emotional attachment/love, sex, gender, and reproduction. It is anchored in thoughts, fantasies, desires, beliefs and values and is expressed through identity, attitudes, values, roles, behaviours, and relationships. Sexuality is a result of the interplay of biological, psychological, socioeconomic, cultural, ethical and religious/spiritual factors.

3. Sexual Health: Sexual health is the ongoing process of physical, psychological, and sociocultural well being in relationship to sexuality. Sexual health can be identified through the free and responsible expressions of sexual capabilities that foster harmonious personal and social wellness, enriching life within an ethical framework. It is not merely the absence of dysfunction, disease and/or infirmity. For sexual health to be attained and maintained it is necessary that sexual rights be recognized and exercised.

These definitions help to clarify the importance of using multiple frames of reference (i.e. biology, psychology, sociology) to appreciate the complexities of human sexual behaviour and identity, especially as it evolves over the lifespan. And perhaps no other consideration is as central in the contemporary study of human sexuality than the ever-evolving “nature-nurture” debate, i.e., factors that are shaped by human biology being contrasted with factors shaped by social, cultural, and interpersonal circumstances (Abramson & Pinkerton, 1995; Fausto-Sterling, 2000; LeVay, 1993).

One of the greatest challenges in conducting primary research about human sexual development and behaviour is that there are typically many obstacles to collecting valid and reliable data (Wagstaff, Abramson, & Pinkerton, 2000, p. 31). Due in part to an increased emphasis since the 1980s on a biomedical/clinical model of treating sexual
dysfunction (Leiblum & Rosen, 1989, p. 5), many therapeutic models for assisting people with questions about their sexuality have been based on diagnosis and treatment of sexual disorders. However, as Nelson (2000) has pointed out (p. 109), much of what is known in the biomedical scientific community about “normal” processes of sexual development and behaviour in humans is explained through research on biological and/or environmental circumstances that contribute to some people and nonhuman animals undergoing “anomalous” sexual differentiation in various developmental stages of life. This suggests that in order to understand the full range of human sexual experience and behaviour, researchers and counselors need avenues of inquiry beyond those which focus on medical pathology alone, including an emphasis on improving interpersonal communication in sexual relations and providing positive affirmation of diverse forms of human sexual and gender identity expression (Queen, 1996; Wilson, 2000).

II. Biological Aspects of Human Sexuality

At its most basic level, human reproduction is the foundation of human sexual behaviour. As Bancroft points out (2002), cultural factors have historically shaped much of human sexual expression but in the final analysis we must take into consideration the fundamental aspects of biology, namely sexual arousal and response, when we strive to fully explain “the complexities and problems as well as the positive aspects of the human sexual condition” (p. 15).

The biological study of human sexuality is not simply focused on reproductive behaviour. It also has as its central focus the processes by which the human body develops both physiologically and neurologically, beginning at the fetal (prenatal) stage and continuing throughout the human lifespan. However, because humans interact with
their environment, research on the biological aspects of human sexuality must often factor in the complex interplay between environmental influences and, for example, the continuing development of the nervous system during childhood (Bancroft, 2002, p. 19). Nevertheless, there are some fundamental biological concepts of human sexual development which have been recognized as key determinants. These include sexual differentiation, brain mechanisms involved in sexual response, and the role of sex hormones (sometimes referred to as “gonadal” hormones).

The process of human sexual differentiation is highly complex, and at the earliest stages of fetal life (before birth), it involves both genetic and hormonal factors that lead under typical circumstances to the birth of genetic males (with 46XY sex chromosomal structure) and genetic females (with 46XX sex chromosomal structure). This process is also called “sexual dimorphism” (Goy & McEwen, 1980; Sizonenko, 2001). It occurs in the brain and central nervous system (Gorski, 1998; Woodson & Gorski, 1999) as well as through the development of the internal and external genitalia (“gonadal differentiation”) resulting in formation of the testes and ovaries in the respective male and female fetuses. In 46XY males, a specific portion of the Y chromosome known as the SRY gene (or sex-determining gene region of the Y chromosome) is responsible for the actual signaling that triggers formation of the testes within the fetus. As the testes are formed within the male fetus, the normal result is for the production of testosterone and Mullerian Inhibiting Hormone (MIH), which suppresses further development of portions of the fetal embryo which could otherwise develop into internal female reproductive organs.

What is essential to understanding the biological process of human sexual differentiation within the developing fetus is a central rule, summarized by LeVay (1993,
pp.17-29) in his chapter, “For a woman wert thou first created: The biology of sexual development”. Namely, nature’s “default switch” is set to produce a female brain and body in the absence of sufficient circulating testosterone levels within the bloodstream, regardless of the chromosomal makeup of the evolving fetus. Money (1988) calls this the principle of “Eve first, then Adam” (p.18). When testosterone and MIH are both present in adequate supplies in the embryo, the 46XY male fetus begins to develop internal genitalia (also known as Wolffian ducts), external genitalia, and structural differences in the brain and central nervous system particularly within the hypothalamus (Gorski, 1998; Woodson & Gorski, 1999). The production of testosterone is referred to as masculinization of the fetus and the generation of MIH is referred to as a defeminizing hormonal influence.

Another significant factor in the biological aspects of human sexual development and differentiation is the impact of sex hormones. Hormones are basically “chemical messengers,” or signal transducers, that are released by the endocrine glands and circulate in the bloodstream. They have two primary functions as far as sexual development and behaviour are concerned: organization and activation (Nelson, 2000, p. 103). The organizing effects of hormones occur first during fetal development, shaping the basic process of human sexual development including neurological aspects. Activating effects of hormones determine the nature of human sexual response and sexual behaviour.

Typically, what are known as “gonadal” sex hormones (Bancroft, 2002) in humans are broadly classified into androgens (most prominent in males) and estrogens (most prominent in females), although other hormones including progestins also have an effect on human sexual development. The most common androgen is testosterone
(Alexander & Peterson, 2001), which as noted earlier, plays a central role in the masculinization and defeminization of the human male brain and body before birth. Androgens are synthesized by the male testes which produce sperm. Testicular/androgen production in males typically initiates during the 6th week of gestation, and soon afterwards the human reproductive system and the brain show signs of differentiation between males and females.

In females, the typical pattern is for development of the ovaries after the 2nd month of fetal life. Ultimately, the ovaries will synthesize the estrogens (including estradiol) that are circulating within the bloodstream of the female. The levels of what are called “prenatal hormones” (that is, hormones existing in the normally developing male or female fetus) play a role in the sexual differentiation of the brain, affecting the neural pathways in the hypothalamus, which is the part of the brain that controls the endocrine system. Then, at puberty, the hypothalamus (if feminized) will direct the cyclic secretion of sex hormones controlling the female menstrual cycle or, in the male, it directs a continuous production of male sex hormones (principally testosterone).

Ultimately, both males and females have some levels of both major hormones circulating in the blood, but typically at substantially different ratios (Nelson, 2000, p. 141). Because of the organizing effects of gonadal hormones upon human behaviour, research into the primary bases of male and female sexual behaviour are of particular interest in fields such as behavioural endocrinology. Hormones play essential roles throughout adolescent and adult lives in influencing the overall sex drive, or libido, which underpins much of human sexual behaviour. Male sex drive typically is expressed after puberty as the testes become more active and circulating testosterone levels in the
bloodstream are increased. Male sexual behaviour is summarized by Nelson as constituting two primary phases, both of which are influenced by hormone levels: the appetitive phase (consisting of all behaviours of the male that are associated with gaining access to the female, as in courtship), and the consummatory phase (consisting of the actual act of copulation). Hormones in males play a significant role in shaping both sex drive and sexual performance, and particular regions of the hypothalamus contain the nervous system tissues that enable integration of environmental, physiological, and psychological information necessary for the male to participate in copulatory behaviour. Nevertheless, Nelson notes (p. 258) there is no clear correlation between blood testosterone concentrations and frequency of sexual behaviours among human males, and no solid evidence exists to support a belief that variations in normalized hormone levels in males or females are associated with greater incidences of homosexuality (p.179).

Both Nelson and Bancroft (2002) have acknowledged that many questions remain unanswered in research on hormonal influences over female sexual behaviour in humans. The most recognized concept is that female sexual behaviour is typically divided into three basic components: attractivity, proceptivity (i.e. female initiation of copulatory activity), and receptivity (the state of responsiveness to sexual behaviours of others). Estrogens within the female bloodstream tend to enhance each of these behavioural components, while progestins tend to reduce them. Additionally, copulatory behaviour associated with actual reproduction in females is in turn associated with ovulation cycles.

One area of reproductive behaviour that has been studied more extensively in both females and males is the impact of aging on hormone levels and associated sexual activity, behaviour, and interest (DeLamater & Friedrich, 2002). For example,
menopause, resulting from the cessation of menstruation in women, is associated with a decline in the body’s estrogen production, and commonly occurs over a 2-year period somewhere between ages 40 and 60. As menopause continues, several physiological changes occur in the sex organs of the female that may lead to reduced desire for and comfort with sexual activity or which may trigger a variety of sexual dysfunctions (Heiman, 2002). The most commonly reported sexual dysfunctions among women aged 50 and over are reduced libido (28-29% of women in their 50s) and infrequency of orgasm (35% of women aged 55-59, compared with only 8-14% of women in their 40s). However, despite the declines in some forms of sexual expression such as coitus, many women still are able to have a variety of options for sexual expression well into their 70s (DeLamater & Friedrich, 2002; Kellett, 2000).

Perhaps one of the more intensively researched issues associated with sexuality and aging has been the trend toward documenting “male menopause”, also known as andropause (Carruthers, 2001; Mailhot, 2001). Typically, males will experience declining levels of serum testosterone levels in their bloodstreams by the age of 60 (Nelson, 2000, p. 257), and for many, erectile dysfunction may be more prevalent with age. Some males also develop a condition known as hypogonadism in which testosterone levels fall below normal levels at far earlier ages. Declines in androgen levels in males may be associated with impaired sexual desire and performance (Mailhot, 2001), but many other symptoms of andropause, such as mood disorders, insomnia, and increased nervousness may be more elusive for doctors to diagnose and treat (Carruthers, 2001).

No discussion of the biomedical aspects of sexual dysfunction in males and females would be complete without at least a recognition that some drugs have
significant negative effects on normal sexual functioning. These include alcohol, benzodiazepines, some anti-depressants in the class of selective serotonin reuptake inhibitors (SSRIs), and certain types of anti-convulsants (Kellett, 2000). Because sexual dysfunction is reported as a side effect of most newer drugs, it is important to factor in any current drug use by individuals—particularly those over age 40—who are currently under medical or therapeutic care for problems related to sexual or reproductive health.

III. Psychology of Human Sexual Behaviour

Although much of our knowledge about the “science” of human sexual behaviour research has been grounded within the biological and biomedical research frameworks, there are many contributions from the fields of the social and behavioural sciences as well (American Psychological Association, Division 44 Committee on Lesbian, Gay, and Bisexual Concerns, 2001; Bohan & Russell, 1999; Firestein, 1996; Friedman & Downey, 1999; Patterson, 1995; Szuchman & Muscarella, 2000). As Abramson & Pinkerton (1995) remind us, sexual activity and identity in humans is not just about reproduction:

‘Reproduction’ now consists of male-female vaginal intercourse, between fertile individuals, at the right time of the month (ovulation), and without the interference of contraception. ‘Sex’, on the other hand, encompasses everything else. Since sex is now divorced from reproduction, it is free to serve other beneficial functions among the higher primates, including facilitating bonding, enhancing group cohesion, promoting conflict resolution, and so on. In many ways, nonprocreative sex is now closer in meaning to hugging and kissing than to baby-making intercourse. Nevertheless, society insists on viewing all sexual activity through the foggy filter of reproduction and ‘survival value’ of these behaviours. Need this be so? (p. 29)

In many ways, psychologists have been able to examine a much wider spectrum of sexual behaviours, feelings, desires, identities, and expressions when they have acknowledged and affirmed the full potential range of sexuality among humans. This includes the innate capacity to experience and share pleasure, which Abramson &
Pinkerton recognize as a core aspect of our biology as well as our emotional lives. Freed from the rigid constraints of a strictly “scientific” biomedical model of sexual behaviour, we may have more opportunity to comprehend the complex interplay among human biology, the culture, the family, the community, and the individual in shaping each person’s unique “erotic themes” (Bem, 1996; Morin, 1995). In turn, this broader approach may enhance our capacity to understand diverse ways that humans experience their sexuality, sexual orientation, gender identity, and sexual lifestyle options (DeLamater & Freidrich, 2002).

Psychologists can provide an intellectual and scientific bridge between the biomedical research arena and public health concerns about protecting and promoting healthy sexual behaviours (Ross, 2002). Of particular concern to the public health system is the effective measurement and reduction of HIV/AIDS and other sexually-transmitted diseases (STDs), recognition and treatment of infertility and sexual dysfunction in males and females, awareness and prevention of sexual abuse and reductions in incidences of teen pregnancy. But sexual health should include the ability for an individual to “understand and weigh the risks, responsibilities, outcomes, and impacts of sexual behaviour” (Ross, 2002, p. 8), and it includes the right to integrate sexuality comfortably into one’s own life, the right to privacy, and the right to express one’s sexuality in culturally appropriate ways so long as they do not infringe on others’ rights. This freedom of expression could be seen as including the rights of individual adults to experience diverse forms of sexual desire, sexual orientation, and gender identity free from coercion, shame, or fear—an approach which some therapists have described as a “sex-positive perspective” (Queen, 1996).
Psychological research on human sexuality is an integrative activity in that it draws insights from a wide range of scholarly and applied disciplines in order to fully comprehend the dimensions of human behaviour. Theory on sexuality is drawn from diverse fields in the life sciences, humanities, cognitive sciences, mathematics, “prevention research”, and the social sciences (Wagstaff, Abramson, & Pinkerton, 2000). Empirical research on sexual behaviour can also follow a variety of data-gathering directions in quantitative and qualitative modes of analysis, including interviews, focus group discussions, surveys, direct observation, studies of social networks and subcultures, clinical research (such as hospital, private clinic, or therapist’s office), laboratory research, and field studies.

For ethical reasons, much of research on human sexual behaviour has to be concerned with protecting the privacy, anonymity and dignity of individuals. Quite often a researcher must rely on individuals’ self-reports of sexual experiences, and this can create obstacles to goals of obtaining valid and reliable data on actual sexual behaviours or interests. As a result, clinical research often affords some of the highest degrees of validity and reliability. Clinical research settings are most commonly involved with assessment and treatment of sexual dysfunction (disorders of arousal/desire, orgasm, and erectile function), and much less so with overall issues of sexual health and lifestyle (Leiblum & Rosen, 1989). However, many clinical therapeutic settings may provide opportunities to assist individuals in evaluating and improving their own sexual satisfaction as an avenue toward improved self-esteem and psychological health across the lifespan (Morin, 1995; Wagstaff, Abramson, & Pinkerton, 2000, p. 37).
Sexual health and behaviour in males is a particularly challenging area for conducting research, in part because of the complexity of analyzing the interplay between social constructions of masculinity and the biological aspects of behaviour (Everaerd, Laan, & Spiering, 2000; Friedman & Downey, 1999). Males are more commonly reticent with regard to frank discussions of sexuality issues than are women, especially any issues about which they feel shame and/or guilt (Meth & Pasick, 1990; Osherson, 1992). These can include failures of sexual performance (such as chronic erectile dysfunction), feelings of inadequacy regarding intimate relationships and interpersonal skills with women, and internalized homophobia.

Indeed, it can be argued that so much of contemporary masculinity is rooted in a “performance script” that all too often males are not even in touch with a language of vulnerability that would enable them to seek help from others. Traditional competitive masculine cultural norms render many men incapable of admitting any weaknesses whatsoever (Kimbrell, 1995; Levant 1995), even to themselves. And yet, no matter how dysfunctional it may seem, these norms for many males are the essence of an evolving process of masculine gender identity formation, the questioning of which carries many inherent psychological risks—-not the least of which is admission of any weaknesses or inadequacy whatsoever—because of fears that such an admission might be interpreted by others as a sign of failure.

When examining male sexual behaviour and identity, researchers are encouraged to recognize that many of the issues about masculinity asked by biomedical scientists are themselves socially constructed (Fausto-Sterling, 1995). As Nelson (2000) reminded us, many of the “scientific” findings about “normal” male sexual behaviour and development
(for example, penis size at birth and resulting gender identity assignment when ambiguous genitalia—or “intersexuality”—is present) are based on scientific assessment of “abnormalities” in male biology that, for example, may be results of too much or too little available testosterone during fetal developmental stages. But at the end of the day, much research still needs to be done that examines the impact of the social environment in shaping and reinforcing male sexual expression, and this quite often falls to the responsibility of psychologists and psychotherapists (Friedman & Downey, 1999).

In the broad realm of psychological research on male sexuality, Everaerd, Laan, & Spiering (2000) identified three primary perspectives: the body perspective, the emotional perspective, and the social and cultural perspective. The body perspective focuses most exclusively on biology: sexual response is the product of stimuli being recognized as sexual by the brain and central nervous system as well as a variety of neurochemical and hormonal processes within the body. Sexual stimuli are typically of either sensory, fantasy, or memory origin, and much of the research focus is upon diagnosis and treatment of particular psychiatric disorders or physiological dysfunctions such as desire disorders or erectile dysfunction. By comparison, the emotional and socio-cultural perspectives focus more attention upon understanding the environmental influences over the sexual feelings, orientations, and behaviours of the individual. Within these perspectives, less emphasis is placed on diagnosis and treatment of dysfunction or “abnormality” than on comprehending and supporting the subjective human experience of sexual excitement, pleasure, erotic and emotional attachment (Morin, 1995).

Compared with research on male sexual behaviour, much of the historical study of women’s sexuality has, until the last few decades of the 20th century, remained mired
in mystery (Everaerd, Laan, Both, & Van der Elde, 2000). In large part, this phenomenon has existed because women have historically not been empowered to express their own questions, concerns, or needs with regard to sexual behaviour, identity, and health. However, when the full range of research contrasting male and female sexuality is examined, men and women are actually not so different in their sexual responses and proclivities, argue Abramson & Pinkerton (1995). For example, they point out the presence of studies which confirm that men and women are equally arousable, given the proper stimulus, a point which runs counter to prevailing “myths” of women being passionless or devoid of a proclivity toward active sexual expression (p. 121). In more recent times when the psychology of female sexuality has been accepted as a legitimate area of scientific inquiry, a variety of specialty topics on women’s behaviour have been developed more thoroughly, some of which emphasize the subjective dimensions of sexual pleasure, attraction, desire, and identity in women (Friday, 1991; Hite, 1993), while others have even investigated the phenomenon of sexual aggression among women (Anderson & Stuckman-Johnson, 1998).

Due in part to the predominance of the role of biology in much of what research did exist on female sexuality (as characterized, for example by the work of Masters and Johnson on human sexual response in the 1960s), feminists after the 1960s became highly critical of the “biology is destiny” perspective (Hite, 1993). The result was almost an outright rejection of the role of biology and the body in constructions of gender and sexuality in much of research on women’s sexual behaviour (Everaerd, Laan, Both, & Van der Elde, 2000). Although research about the physiological determinants of women’s sexual arousal and reproductive health disorders (including any understanding of the role
of hormones) was given less credence in feminist circles, there has been a rich array of studies cited by Abramson & Pinkerton (1995) that demonstrate the interplay of biology and psychology in explaining the diverse dimensions of sexual pleasure in females.

IV. Variations: Sexual Orientation, Gender Identity, Intersexuality, Transsexualism and Transgenderism

Since psychologists who specialize in human sexual behaviour seek to explore the myriad forms of human feelings and expression of their sexuality, it goes without saying that there are many ongoing questions about ways of defining “norms” in terms of sexual orientation, gender identity, and variations in sexual lifestyles across the lifespan. At the core of many ongoing debates is the interplay between biology and culture. The words of Abramson & Pinkerton (1995) on sexual orientation are instructive:

Adopting an interactionist stance, all forms of human sexual behaviour, heterosexual and homosexual alike, are probably influenced by both biological and cultural factors, acting separately or in concert. Attempts to separate the biological from the cultural are fraught with difficulties. Ultimately, all behaviour rests on biology, even behaviours that reflect significant cultural biases and influences. And because the brain mediates sexual behaviours ranging from the simple to the intricate, it seems reasonable to expect that sexual orientation would at some level be encoded within the brain. The existence of brain regions that are dimorphic with respect to sexual orientation therefore says little about ultimate causes. (p. 94).

Similar recognition exists for variations in ways that persons experience and express their gender identity across the lifespan. In their chapter on transgender issues, Cole, Denny, Eyler, & Samons (2000) contend:

It is possible that, given sufficient time and further research, causal mechanisms for many human behaviours, perhaps even transsexualism, will be elucidated. Currently, however, it is clear that gender, like sexual orientation, is in many ways an individually based and self-perceived characteristic, the origins of which are not well understood. Gender (and transgender) may evolve in a variety of ways and should not be restricted by societal prejudice. (p. 153).
Counselors and psychologists are somewhat uniquely positioned to provide emotional support as well as an inquiring mind to the process of aiding persons who are sorting out questions with regard to their own sexual and gender-related identity, behaviour, and feelings (American Psychological Association, Division 44 Committee on Lesbian, Gay, and Bisexual Concerns, 2001; Bem, 1996; Bohan & Russell, 1999; Bushong, n.d.; Patterson, 1995). Psychologist Beth Firestein (1996), a specialist in bisexuality, recognizes the significance of positive affirmation for both the fluidity and variability of human sexual and gender expression:

The understanding of sexual orientation is significantly enhanced by using models that can account for the diversity of ways in which individuals experience and express their sexual attractions, behaviour, and relational involvements. A new ‘LesBiGay/Transgender’ affirmative paradigm is emerging, one capable of providing meaningful explanations of the wealth of data generated about sexual orientation, gender, and sexual behaviour over the past 50 years … Choosing to challenge the assumptions of the dichotomous paradigm regarding sex and gender [male/female, feminine/masculine, gay/straight], as well as sexual orientation, makes the emerging paradigm a more profoundly liberating source of transformation. (pp. xxi-xxii)

Arguably, “challenging the assumptions of the dichotomous paradigm” is a process that must also happen when evaluating research on both the socio-cultural and biological aspects of human sexuality and gender identity. Heterosexual and often homophobic biases and dichotomous gender assumptions (i.e. males are masculine, females are feminine) are the norms which underpin research questions about human development and behaviour, and often they play significant roles in shaping and limiting the questions asked by biomedical researchers about sex or gender issues (Kotula, 2002).

Another significant area of research about the psychology of human sexual behaviour is psychosexual development, which is typically recognized as sexual differentiation of the brain and behaviours and the emergence of a “core gender identity”
(Hines, 1998; 1999). There has been increased attention paid to what is called the prenatal hormonal environment in humans—that is, the level of hormones in the developing fetus—and how it is linked to subsequent sexual differentiation or sexual dimorphism of the brain and the body. When psychosexual development is disturbed by chemicals which interfere with appropriate hormonal functioning and physiological sexual differentiation (see Sizonenko, 2001), it is possible that sexual development follows an abnormal pattern, as the discussion below will illustrate.

Although researchers in fields of biology, endocrinology, and neuropsychology have examined developments within the brain associated with such areas of human development as gender identity, sexual orientation, and processes of primary sexual differentiation (LeVay, 1993; Nelson, 2000; Solms & Turnbull, 2002), it is less well understood just how much of a role hormones play in determining how a person subjectively experiences his or her sense of gender identity or sexual orientation compared with the impact of social, familial, or cultural circumstances in which a person develops (Fausto-Sterling, 2000). However, a number of aspects of disturbed sexual differentiation have been identified and studied in humans, most notably intersexuality, transsexualism, gender dysphoria, and other types of gender identity disorders (GID). Many of the psychological effects of these conditions have been diagnosed and treated by psychiatrists and psychologists as a result of years of clinical research and a substantial body of relevant scientific literature within the biomedical and psychological arenas (Bushong, n.d.; Cohen-Kettenis & Gooren, 1999; Diamond, 2002; Michel, Mormont & Legros, 2001; Rekers & Kilgus, 2001; Wilson, 2000).
As Blackless et al. (2000) have determined from their comprehensive review of biomedical literature on sexual dimorphism in humans, there are numerous conditions that can interfere with either chromosomal composition, gonadal structure, hormonal levels, or the structure of the internal genital duct systems and external genitalia. In fact, there are more than 25 different medical diagnoses affecting sexual differentiation, and Blackless estimates that almost 2 percent of all live human births result in some form of non-dimorphic condition (p. 161). Among the most common is intersexuality, a condition in which the external genitalia at birth are ambiguously developed, resulting in uncertainty as to the biological sex and appropriate “gender identity” of the newborn (Diamond & Sigmundson, 1997; Diamond, 2002; Fausto-Sterling, 2000; Money, 1988). Intersexual persons typically receive reconstructive surgery and are assigned a gender at birth, but some individuals experience significant psychosexual difficulty in subsequent years due to incongruity between gender assignment and the subjective feelings of gender identity. Although Money’s research on intersexuality led to his contention that persons are born psychosexually “neutral” at birth, Diamond & Sigmundson argue that in many cases this is a fallacious assumption, and suggest that psychotherapeutic attention is often necessary to assure optimal psychological support for the intersexed child as puberty is experienced—particularly in circumstances in which the individual may be experiencing serious incongruence between his or her assigned gender and actual sense of gender identity.

Another major area of research into atypical sexual development in humans is transsexualism (Cohen-Kettenis & Gooren, 1999; Diamond, 2002; Michel, Mormont, & Legros, 2001). Diamond defines transsexuals (2002, p. 324) as “those adult individuals
who manifest the diagnostic criteria for gender dysphoria or gender identity disorder (GID).” GID is recognized in the American Psychiatric Association’s *Diagnostic and Statistical Manual of Mental Disorders*, edition IV (DSM-IV) as representing a relatively severe form of gender identity conflict, and there are separate diagnostic criteria for assessing GID in children (section 302.6) and for adolescents and adults (section 302.85). According to Michel, Mormont, & Legros (2001), the first distinct conceptualization of transsexualism as a medical condition was by an American endocrinologist, Harry Benjamin, in 1953, who characterized the transsexual as having an “unshakeable conviction of belonging to the opposite sex, presenting a most severe gender identity disorder. Gender identity is therefore totally in disharmony with corporal reality, forcing the individual to request sex reassignment surgery” (p. 365). Benjamin’s book *The Transsexual Phenomenon* (1966) broadened awareness of the possibilities of sex reassignment surgery (SRS) and although considerable social stigma existed around persons with cross-gender identity for many years, many medical professionals and gender specialists have increasingly adopted a more positive attitude toward supportive diagnosis and treatment of GID, including some forms of national health insurance covering the costs of SRS (Cohen-Kettenis & Gooren, 1999).

Transsexualism is but one possibility among a myriad of variations in gender identity that can be experienced by both males and females. In fact, a much broader spectrum of persons may identify themselves as “transgendered” in that they may experience moderate amounts of gender dysphoria or strong identification with persons of the opposite sex, but not enough to warrant either a desire or a need for SRS (Bushong, n.d.; Cole, Denny, Eyler, & Samons, 2000). Some advocates of “gender identity reform”
have argued that the current practice of labeling gender identity disorder as a mental illness in the DSM-IV stigmatizes many gender-variant persons and unnecessarily deprives them of personal rights and freedoms (Wilson, 2000). Because homosexuality was removed as a mental disorder from the DSM in 1973, it has been suggested that the current diagnostic approach to gender identity could also become less rigid and less based on presumptions of “distress and impairment” among those with cross-gender identification. Nevertheless, more traditional psychiatric proponents have argued that early identification and treatment of gender identity disorder may help to reduce the high incidence of depression and suicide attempts in adult males who developed the disorder sometime in childhood and remained untreated (Rekers & Kilgus, 2001).

Quite possibly, a more fluid definition of gender identity and variations in gender expression is warranted, particularly in relation to the notions of transgenderism (Bushong, n.d.). One of the most compassionate approaches to celebrating the potential gifts of diversity of expression of gender identity (Denny & Green, 1996) recognizes parallels between bisexuality and transgenderism, seeing both as not only terms of personal identification but also as ways of experiencing a more fluid nature for both sexual orientation and gender identity. The authors included in Firestein (1996) demonstrate how urgent it is for psychologists and therapists to be aware of the internal and external oppression that many people experience as a result of their sexuality or gender identity. Arguably, in times when transgendered individuals are feeling more vulnerable to attacks within their communities, this support role can be a vital link to preserving the emotional well-being and sexual health of transgendered clients.
V. Prenatal Hormones, Endocrine Disruptors, and Human Sexuality

In a report published in *Transgender Tapestry*, the official journal of the International Foundation for Gender Education (IFGE), Kerlin & Beyer (2003) describe the results of more than three years of research conducted with the DES Sons’ International Discussion Network, an online electronic community of individuals from around the world who were prenatally exposed to a potent synthetic estrogen, diethylstilbestrol (DES), that was at one time prescribed to women for guarding against miscarriages. The story of DES and its carcinogenic effects in women (especially the daughters of mothers who used the drug while pregnant—so-called “DES Daughters”) has been told by many in the past (Berkson, 2000), but less information has historically been available on the immediate and long-term health effects of DES sons. This fact, in part, was a motivation for Kerlin & Beyer’s subsequent research.

What has been confirmed about DES is that it is a synthetic chemical that mimics the natural sex hormone estrogen; it has been implicated in a variety of reproductive system cancers and infertility in female and probably also male offspring (Giusti, Iwamoto, & Hatch, 1995); it has been found to have significant negative effects on the structural development of the male reproductive system (Gill, 1988; Laitman, Jonler, & Messing, 1997; Sharpe & Skakkebaek, 1993; Skakkebaek, Meyts, & Main, 2001; Toppari & Skakkebaek, 1998); it has been implicated in suppressing the activity of a gene, called Wnt-7a, that normally plays a vital role in the development of the male and female reproductive tracts (Travis, 1999); it has been associated with increased rates of major depressive disorder, anxiety disorders, and disorders of sexual desire (Meyer-Bahlburg et al., 1985; Saunders, 1988); and researchers have pointed to abnormal sex differentiation
of the fetal hypothalamus as being the most common by-product of DES exposure (Walker & Kurth, 1993). Because of its recognition as a toxic carcinogen, DES has been banned for use with pregnant mothers. Until recently it still received limited recommendation for treatment of advanced prostate cancer in males because of its ability to rapidly reduce testosterone levels, essentially inducing andropausal symptoms. It is officially documented by the National Toxicology Program (NTP) of the U.S. National Institutes of Health (NIH) as having the following effects in males: impotence, transsexual changes, developmental abnormalities of the fetal reproductive system, abnormal spermatogenesis, and anatomical changes in the testes, epididymis and sperm duct (NTP, 2001).

So why is DES significant for the current discussion about hormones and human sexuality? In part, it is because DES functions as one of the most potent endocrine system “disruptors”. Literally speaking, it disturbs the normal biological process of sexual differentiation in animals and in humans (Berkson, 2000; Toppari & Skakkebaek, 1998). Developmentally speaking, it can disrupt the normal levels of what are called “prenatal hormone levels”, or the hormonal functions that normally occur during prenatal development of the human fetus. Prenatal hormonal development in males—especially the generation of testosterone—is linked to development of the primary and secondary reproductive organs and of the human brain. Variations in normal levels of prenatal hormones can have an effect on the organizing aspects of the sexual brain (Dorner et al., 2001), or in other words, on sexually dimorphic behaviours, particularly in terms of sexual orientation, gender identity, and gender role behaviours (Alexander & Peterson, 2001). Dorner et al. explain it this way:
Alterations of sex hormone and/or neurotransmitter levels during a critical period of brain development lead to permanent structural and biochemical changes of brain regions, which are associated with life-long variations of sexual orientation, sex-typical behaviour or gonadal function. Thus, the development of female and male bi- or homosexuality—that means a preference of sexual behaviour with partners of the same sex—could be caused by a deficiency of androgens in males and an excess of androgens or even estrogen levels during sexual brain differentiation.

By now, the implications of the DES story for human reproductive health and sexual behaviour should be quite clear. But there are broader implications for sexual health which still need to be discussed. One of the most critical issues is the implication of environmental hormone disruptors for overall reproductive health in humans, an issue which has recently been raised in a report on global assessment of the effects of endocrine disrupting chemicals sponsored by the World Health Organization (2002). Berkson states that “for a male to become a male and a female to become a female, male and female hormones [i.e., androgens and estrogens] must be present in the mother in the right amount at the right time between fertilization and birth” (2000, p. 42). Further, Solomon & Schettler (2000) contend that because hormones act at extremely low levels, exposure of the human fetus to even small amounts of hormonally active chemicals (such as DES or other environmental estrogens like DDT, dioxins, and PCBs) may affect fetal development during sensitive periods. If, as some believe, environmental estrogens may be linked to increases in reproductive disorders in males (Sharpe, 2001; Skakkebaek, Meyts, & Main, 2001), their increased presence in our food and water supplies may have broader impact on future human reproductive health.

A further implication of the DES story is one dealing directly with issues of “core gender identity”, as defined by Hines (1998, 1999), and sexual orientation and the potential that both are influenced by exposure to endocrine disrupting chemicals.
Evidence suggests that prenatal hormones, if disturbed at critical stages, may lead to intersex conditions in humans and, in the case of persons born as 46XY males, may lead to individuals having “feminized” brains and/or bodies. This result may be difficult to measure scientifically in humans, but the presence of a significant number of transgendered persons within communities of DES-exposed offspring would seem to offer a hint of potential associations between prenatal DES exposure and gender variance in later years. Indeed, researchers have examined questions about prenatal disturbances of sexually dimorphic behaviour and potential feminizing influences in DES-exposed males as long ago as the early 1980s (Ehrhardt & Meyer-Bahlburg, 1981; Goy & McEwen, 1980; Hines, 1982; Kester, Green, Finch, & Williams, 1980; Reinisch, Ziemba-Davis, & Saunders, 1991; Yalom, Green, and Fisk, 1973). Further research has provided tentative empirical links between prenatal DES exposure in females and higher incidences of lesbianism and bisexuality (Meyer-Bahlburg, et al., 1995). In essence, what we have in the DES story is evidence of “chemically-induced” sexual and gender variance.

What are the implications for psychology from this example of environmental endocrine disruptors? In part, we learn the importance of ongoing “nature-nurture” debates about the ultimate causes of human behaviours, and we learn to respect that there are no absolute laws of what shapes an individual’s gender, sexual behaviours, feelings, or proclivities. Hopefully, we also develop a greater respect for the role that biological influences may play on human behaviours. And, we should recognize that many persons who suffer from the effects of endocrine system disturbances brought on, perhaps, by exposure to endocrine disrupting chemicals may not even be aware that their symptoms such as major depressive disorder, declining libido, erectile dysfunction, or early onset
andropause (Carruthers, 2001) or menopause are in fact being caused biologically, and therefore may not be “curable” by psychotherapy alone. They may instead necessitate at minimum, medical assessment and treatment if endocrine system disorders are diagnosed.

Psychologists and therapists are often able to observe and assess the subjective experiences of gender identity and sexuality as expressed by their own clients, if the climate within the therapeutic environment is conducive to client self-disclosure around these issues. As much as scientific research has been able to predict the likelihood of an individual person being affected in some fundamental biological way (such as core gender identity) by a history of exposure to some toxic substance that may have affected his or her sexual development, the human subjective experience is far less clear-cut, much more subject to variability due to the unique mix of cultural and environmental factors shaping his or her life.

VI. Conclusion

This paper has introduced a number of frames of reference for understanding and researching the complex nature of human sexual behaviour. It is a fascinating subject for psychological study, perhaps because it goes to the core of what makes us human—biologically linked in some fundamental ways with the animal world, yet uniquely capable of creating social, behavioural, and lifestyle choices. Our sexuality and our gender identity are no doubt determined, to a large extent, by hormonal activities, and we should have a clear understanding of just how powerful are the influences of hormonal changes across the lifespan when attempting to evaluate the quality of our own sexual health. But in order to take control of our own sexual health, we must be fully conscious about the effects of subtle, sometimes coercive effects of our culture, our communities,
and even our families in determining or denying our freedom to pursue a sexual lifestyle or gender identity that feels most in harmony with our subjective sense of self and our needs.
References


