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Sex-gender diversity: an evolutionary point of view

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Update by subjects

ABSTRACT

Introduction
There are people with a gender incoherence between their biological gender (phenotype) and the self-perception gender. Differences among such condition and sexual orientation give us more subtypes of gender and sexual diversity: transsexual, travesties and transgender, homosexual, heterosexual, bisexual and asexual.

Objective
To review if there are well supported evidences about sexual and gender diversity as part of evolutionary strategies.

Method
Medical and political historical documents about the birth of the concepts of gender and sexual orientation were consulted at The National Library of Medicine. These were updated, in a review of the scientific literature of the last fifty years in SCOPUS, PubMed and Science Direct systems. The following words were used: homosexuality, transsexuality, gender and evolution.

Results
Because sexual reproduction is so indispensable and so zealously selected, the existence of homosexuality and transsexuality is a kind of paradox. One must wonder: why would not evolution quickly select against behavior, which diverts an animal from sexual reproduction? Yet despite this apparently unlikelihood homosexuality does exist.

Homosexuality is also the innate sexual preference for one's own gender or the biological urge for same-sex coitus. So despite popular non-recognition of the phenomenon, natural history observations have revealed a wide range of homosexuality throughout the animal kingdom.

To account for homosexuality –or any phenomenon– using evolution, it is necessary that it be natural, i.e. it must occur naturally without human influence. Thus, animal behavior is used to illustrate the naturalness of homosexuality. In essence: there are homosexual animals in nature; therefore homosexuality is natural.

Transsexuality is a gender issue, and in psychiatry remains as a mental disease named "gender dysphoria".

Discussion and conclusion
There is some biological basis for these particular human beings, in whom the role of high levels of hormones, antibodies against testosterone receptors, order or birth is also discussed in the present article.

To understand that humans are not a dichotomist species is the main goal of this work, as homo sapiens differences in many aspects of our functions are the norm.

Key words: Transsexual, homosexual, gender, evolution, homophobia.

RESUMEN

Introducción
Hay un grupo de gente con una incoherencia entre el género y su sexo biológico (fenotipo) con el género de autopercepción. Las diferencias entre esta condición y la orientación sexual nos dan una serie de subtipos de género y de diversidad sexual: transexuales, travestis y transgéneros, homosexuales, heterosexuales, bisexuales y asexuales.

Objetivo
Revisar las evidencias que puedan apoyar si la diversidad de género y la orientación sexual son estrategias evolutivas.

Método
Se consultaron documentos históricos, médicos y políticos sobre el nacimiento de los conceptos de género y orientación sexual en The National Library of Medicine. Estos se actualizaron en una revisión de la literatura científica de los últimos cincuenta años en los sistemas SCOPUS, PubMed y Science Direct. Se utilizaron las palabras: homosexuality, transsexuality, gender y evolution.

Resultados
Debido a que la reproducción sexual es tan indispensable y celosamente seleccionada, para continuar la combinación genética, la existencia de la homosexualidad y la transexualidad son una paradoja evolutiva. Hay una gama de este tipo de conductas en los animales de reproducción sexual, en mamíferos, aves, reptiles y peces.

Hasta el momento sólo hemos utilizado el comportamiento animal para ilustrar la naturalidad de la homosexualidad. En esencia: hay animales homosexuales en la naturaleza. Por lo tanto, la homosexualidad es natural, y en este artículo se presentan las explicaciones evolutivas al respecto.

La transexualidad es una cuestión de género, y en la psiquiatría contemporánea sigue siendo calificada como una enfermedad mental, llamada "disforia de género".

Discusión y conclusión
Hay bases biológicas para esta alternativa particular en los seres humanos, en los que el papel de los niveles de hormonas elevados, los anticuerpos contra los receptores de testosterona, el orden del nacimiento y el uso de algunas drogas se discuten en el presente artículo.

Comprender que los seres humanos no son una especie dicotómica es el objetivo principal de este trabajo, ya que en el homo sapiens, las diferencias en muchos aspectos de nuestras funciones es la norma que nos hace tan diferentes, pero al mismo tiempo iguales en derechos básicos como seres humanos.

Palabras clave: Homosexualidad, transexuales, género, evolución, homofobia.

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"Seen in the light of evolution, biology is, perhaps, intellectually the most satisfying and inspirational science. Without that light, it becomes a pile of sundry facts - some of them interesting or curious but making no meaningful picture as a whole."
Theodosius Dobzhansky

INTRODUCTION

Some people have an incoherence between their biological gender (phenotype) and their own perception of their gender, which may be the exact opposite of what they were assigned at birth. The differences between these two conditions, sex and gender, can be further subdivided into others such as transsexual, transvestite, transgender, homosexual, bisexual, heterosexual, and asexual.[1]

Transsexual people have a condition during early stages of life in which they recognize some incoherence around how they see themselves, i.e., that they are incoherent with their external appearance, in how people react to them, and in how they perceive themselves. This is often in direct opposition with how other people see them. In general, transsexual people ask others to call and deal with them using their surname or other name that corresponds to the opposite of the gender they were assigned at birth.[2]

When this sex-gender incoherence appears, seen naturally, it gives a state of discord between how a person appears externally (phenotype, with both biological and social facets) and the perception of "oneself" or self-perception. The latter is a neurobiological function that is generated during gestation. Proprioceptive information, which comes from the extremities, the torso, and the head, creates an integration area in one of the main areas of association located in the join of the parietal, temporal, and occipital lobes of the right side.[3,4] This self-perception is biologically structured and has a continual construct with the child, and the stereotypical roles assigned to gender. It is consolidated and complimented until puberty. In a sense, this is what provides us with an ontological continuity. Factors such as stereotypes about child-rearing, assigning names, roles in childhood games, clothing colors, type of education, and interaction with adults and childhood companions, help to determine how we identify ourselves with one gender in particular.[5] Mechanisms of imitation and empathy, where mirror neurons come into play which mimic and record information about behaviors, gestures, styles of walking, and locution, show that boys will imitate their father and girls imitate their mother.[6]

The beginnings of sex-gender incoherence are seen when the opposite occurs; that it, boys adopt traits of the mother and girls those of the father. In general, this is rarely accepted by the parents, it is denied, or in the worst cases, punished.[2]

It can be deduced from genetics and their expressions such as phenotype, that two pairs of chromosomes are well-defined as responsible for the sex-gender phenotype (XX or XY, for women and men respectively). Gonadal or phenotype sex as man or woman, generally correlate to this first dichotomous division. Intersexual people are the exception to this rule (as they can have an excess: XXX, XXY, or a deficit, XO, of sexual chromosomes).[7] In terms of sexual psychology, men and women are different by virtue of their own gender identity, which means that they recognize themselves as belonging to a specific gender that is in general consistent with their external aspect.[8,9]

Whatever their sexual orientation, gender condition, or biological phenotype may be, these people are human variations of a specific and particular physiological function: sexual activity without the need for reproduction. This position is immediately subversive, and goes against the moral and religious values imposed by the bourgeoisie from the start of the 18th century.[10] The hedonistic part of sexual activity is typical of primates, and has special relevance in three of these in particular: bonobos, chimpanzees, and *homo sapiens*. The variation of the genome in these three species is between 2-3%.[11]

Reproductive function is not the primary goal in human sexual activity, but rather it is that of maintaining active and functioning sexual desire. This has been the case even when there is an absence of women, or where those in certain communities have been unable to reproduce.[11]

Reproduction is not 'cancelled' in homosexual or transsexual people, although it is not a goal in their lives. This observation has been relevant for evolutionary purposes. Why are sexual and gender diversity expressed at constant levels all over the world, even when reproduction among such people is not common? Why do LGBTQI (lesbian, gay, bisexual, transgender, questioning, and intersex) people not reduce in prevalence? Evolutionary strategies that continue throughout a species in particular must be seen as part of the evolutionary frame of reference and of the general mechanism of adaptation. There are numerous examples of differences in sex and gender in the animal kingdom.[12-15]

A male fruit fly, for example, may court other males, because it lacks a gene that allows it to establish the difference between the sexes. But this is very different from male bottlenose dolphins, which dedicate themselves to interaction between individuals of the same gender in order to facilitate the union of the group. Female Laysan albatross can remain consolidated for life and develop cooperative functions in rearing chicks.[16] Few studies have examined whether same-sex relationships actively participate in the evolutionary process in any specific way. This is the proposal of behaviors which persist throughout evolution; those which are useful and are therefore preserved.

Same-sex sexual relationships –courting, mounting behavior, or raising young– are behaviors which may have

been formed by natural selection, by a basic mechanism of evolution, which is produced through successive generations. However, a review of the studies suggests that these sexual behaviors with the same sex can act as selective forces between themselves. In other words, homosexual relationships may contribute to evolution in subtle, alternate, but nonetheless important ways for many animals. When biologists have considered selective pressure in evolution, they tend to focus on environmental concerns such as climate, temperature, or geographical accidents in a particular location. Social circumstances can also have an impact,[14] such as in relationships between people of the same sex, which may radically change social circumstances, for example, through the elimination of some individuals from a group available for partnering. Reproductive competition and selection in primates takes place in the vagina of the female who, in being the possible receptor of multiple males, develops mechanisms of natural selection in terms of sperm quantity and strength, the phase of the female's sexual cycle, and other factors which affect optimization of the reproduction and survival of infants.[17,18]

The Laysan albatross has also been studied, a species in which the females form same-sex pairs and raise chicks belonging to one or both of them. The same-sex behavior in this species may not be abnormal, but rather have stemmed as an alternate reproductive strategy. Almost a third of laysan albatross are female-female pairs and these have more success than unpaired females in terms of raising chicks.[19,20] Same-sex sexual behavior is performed flexibly in a variety of circumstances, for example, as alternative reproductive strategies, in improving cooperation, as facilitators of social bonding, and as mediators of intersexual conflict. Once this flexibility is established, they become a selective force in themselves, which can lead to selection in other aspects of physiology, life history, and social behavior.

THE HOMOSEXUAL AND TRANSSEXUAL PARADOX FROM AN EVOLUTIONARY POINT OF VIEW

While some species of plants and animals reproduce both sexually and asexually, many species are strictly asexual. Through this type of reproduction, the animal creates clones of themselves. All the individuals in a population share an identical genetic structure. This form of reproduction has various advantages. From a behavioral, physiological, and morphological way, it is simple; as such, there is less margin for error. Asexual reproduction occurs in organisms that are well adapted to a particular set of surroundings and which do not have to dilute their genes, which are already adapted from other potentially less adapted parents. Species with asexual reproduction do not have to waste energy finding, attracting, and courting a mate. Nor do they need to evolve specialized and characteristic physical behaviors to carry out this process, such as having strong, large horns, complex song in birds, or intimidating growls; constructing *ad hoc* nests for the female to lay eggs; or in the human species, developing a state of economic security which females find attractive.[6]

For reasons like this, the existence of sexual relations at all is deeply puzzling, in that the majority of creatures would be better off without this activity, which is very energy and time consuming. So, why is sex necessary? Because it makes possible the recombination and perpetuation of genetic codes that have driven evolution, and overcomes damaging mutations in new individuals. While evolution is the driving force of biology, sex is the glue that holds this foundation together. In fact, so advantageous is sex, that in spite of the high biological cost, the majority of macroscopic animals, including 99% of all vertebrates, reproduce sexually.[12]

This is due to sexual reproduction being so indispensable and so zealously selected for existence, that homosexuality becomes a paradox. Homosexuality seems to be the antithesis of sexual reproduction, an enemy of evolution. We may ask why evolution chose a strategy that is counter-reproduction. However, in spite of seeming that homosexuality is counter-evolutionary, this is not the case; it exists, and not as a vagary, as it meets various evolutionary functions.[21] To start with, it is a behavior that is very extensive in all animals with sexual reproduction. Why?

THE DEFINITION OF HOMOSEXUALITY

In order to answer the question of why homosexuality exists and persists, we must first identify it. The term homosexuality has two primary meanings which are distinct but related. Homosexuality is the sexual activity between two people of the same sex. This includes coitus or genital contact between people of the same sex, either face to face, back to face, or in other ways.

Homosexuality is also the innate sexual preference for one's own sex; a biological impulse for coitus between people of the same sex. If much has been made of this distinction between homosexual desires (or innate sexual desires) and homosexual behavior in human beings, this distinction is of limited or insignificant importance in non-human animals, in which we primarily refer to "desire" (either instinctive or learned) on the basis of behavior. There is a huge gap between human desire/biological impulse and animal behavior.[22] Sexual desire and behavior in humans is attributed to social and cultural human customs.[16] In summary, homosexuality is at once the biological unit for desiring coitus between people of the same sex (the intent for activity), and the performing of coitus between people of the same sex (carrying out said activity). Homosexuality has been observed in men and women in both human and non-human

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populations. Even if it is difficult or almost impossible to separate innate impulse for action in non-human animals, the distinction between these two definitions will be important later on, where we discuss possible evolutionary explanations for homosexuality.[23,24]

DENIED HOMOSEXUALITY

In many species of primates, mounting between individuals of the same sex is much more than incidental, and it should not be thought of as an aberration.[25] Female bonobos have been observed to choose genital contact with other females during copulation with a male. During a phase of observation of 58 female bonobos, 45 of them were more committed to homosexual activity, and some were exclusively homosexual. A total of 98 homosexual mounts were observed in male mountain gorillas; these were ventro-ventral and dorso-ventral.[26]

Other mammals also show homosexual behavior. For example, bovine cattle show a proclivity for female-female mounting, which has been noted by milk farmers who look out for this type of behavior as an indicator of the estrous phase. Male-male mounting is a typical behavior in mountain sheep,[26] and homosexual behavior has also been observed in giraffes, rats, dolphins, dogs, deer, donkeys, cats, rams, goats, pigs, antelope, elephants, hyenas, rabbits, wolves, porcupines, hamsters, mice, and porpoises.[26]

Homosexual play is one of the most detected behaviors in mammals. Mounting behavior is carried out indiscriminately, and this leads to the consolidation of groups.[25] Indeed, homosexual activity in adults is more pertinent as training or practice for real reproductive success, but behavior in juveniles could be indicative of the innate nature for sexual desire in general. Various other examples of this type of activity have been recorded in birds, reptiles, fish, and insects. It is remarkable how the morality of one culture has created a series of filters for such widely disseminated behavior in living beings.

HOMOSEXUAL EVOLUTION

Based on the existence of homosexuality in nature, and its frequent taxonomic grouping (that is, closely related organisms which show increasingly similar homosexual behavior), it can be inferred that homosexuality has evolved. However, because nobody has been able to observe the evolution of homosexuality first hand, we can only theorize as to how this happened. Based on behavior studies of homosexuality in humans and animals, a series of models and explanations have been proposed for how this practice, apparently adapted to genetic expression, developed. There are two main types of explanation as to how and why homosexuality is observed in animals:[26]

1. Homosexual behaviors (such as mounting individuals of the same sex and crossed gender mimicry) are not functional, but the secondary effects are not particularly damaging to adaptive behavior. Homosexuality is therefore not intentional (that is, the animal does not have a use for copulation between individuals of the same sex).
2. Homosexuality is adaptive, broadening an organism's capacity to transfer its genes. Homosexuality is therefore intentional (that is, the animal has a specific use for copulation between individuals of the same sex).

Biologists, who generally study a limited range of animals, have gravitated towards one or other of these explanations, and have sometimes extrapolated their theories to explain animal homosexuality in general terms. However, an assessment of the wide spectrum of different homosexual behaviors in the animal kingdom clearly shows that homosexuality developed as both a secondary effect and an advantageous adaptive behavior.

HOMOSEXUALITY AS A SECONDARY EFFECT

The model of the secondary effect of evolving homosexuality has been described.[14] It proposes that homosexuality is the result of an intense need for sexual activity. The functioning of this model has a lot to do with the beginnings of heterosexuality. In mammals, females must carry their offspring during gestation, which limits their potential number of descendents. Men simply need to contribute sperm; however, they cannot have any additional investment during the time their offspring are gestating. Males can produce sperm almost indefinitely, and can father many descendents. Successful mammal reproduction is reinforced when he inseminates many females, which guarantees a larger number of offspring. But a woman cannot produce a greater number of offspring through increased frequency of copulation, so it is therefore not beneficial for a woman to increase her number of sexual partners. A female increases her reproductive aptitude by means of selecting the best father possible for her descendents, which increases her offspring's ability and likelihood of survival. A large difference between male and female sexual behavior in mammals can be explained simply by the fact that females are out of the genetic lottery while pregnant.

Through evolution, men have acquired a behavior which obligates them to compete with other males for females: This leads them to have more frequent copulation and as such, achieve greater reproductive success. The model of secondary effects of homosexuality proposes that male "hypersexuality" leads them to mount a series of both females and males. This excess of male sexual desire has been proposed as a strategy to impregnate more females and maintain active, functional, and facilitated sexual desire.* If,

for reasons of death during childbirth or other reasons, there are not sufficient women in a community, an activity practiced by primates in general (chimpanzees and *homo sapiens*) is the abduction of females from other clans in a surprise attack. Should this not be possible, homosexual activity will be exacerbated.[21]

This theory is well supported by observations of sexual conduct in the animal kingdom. As has been noted, in animals, "homosexuality" is a mistaken term, and really it refers to bisexuality or "ambisexuality" - mounting behavior of animals of both sexes. There are only a few species which have behavior types of homosexual preference (as in some primates, including Japanese macaques).[21]

This model, which suggests that evolution has favored a greater sexual desire in males, is supported in rates of masturbation which have been observed: There are no known human cultures where women masturbate more than men, and the same is true for non-human primates. Rhesus monkeys raised in isolation from their parents (to avoid learned behavior) showed higher rates of masturbation in males, which suggests an innate difference in the intensity of sexual desire.[21]

TRANSSEXUALITY

Subjective experience

Transsexuality is the development of a gender identity which is in disagreement with the morphology of the genitals and secondary sexual characteristics. Gender identity has been defined as "the self-categorization of one's individuality as a man, woman, or ambivalent".[2] In North American psychiatry, it continues to be classified as a mental disorder under the name "Gender Dysphoria".

At what point does a body appear as part of the perceptual field itself? This and other questions are important and related to what we call the structure of perceptive conscience. Such questions can be answered with three focuses: phenomenology, psychology, and cognitive neuroscience.

Awareness of oneself as a learned behavior

Human beings have a specialized area of the brain which processes sensory information acquired by the sensory organs. The five known senses for human beings are sight, hearing, touch, taste, and smell (also known as the exteroceptive senses which also include balance). As well as these basic senses which provide the brain with external information about the world, the neuronal connections throughout the body provide it with information about the different parts which make up the organism,[3] as well as spatial relationships between the different parts of the body.

One apparently obvious point which is not taken into account is that the brain is found within the head of the organism, whereas various sensory organs and internal sensory connections are situated at specific and distal points of the body, and that they are communicating with the brain in a specific way. This is to say that the flow of information from its surroundings contains a constant subset of information related to the organism. All of this takes place from the early phases of gestation. The sense of touch, for example, is already detecting at this stage what belongs to the body, and what is separate from it. Self-awareness continues developing during the first years of life. One key point is when the child can identify themselves in a mirror, and recognize themselves.[3]

Transsexual people also go through this process. The interesting thing is that in spite of recognizing themselves, there is an incoherence with their perception of gender. This is manifested naturally, when they are asked to do tasks that are culturally assigned to their gender at birth and there is a certain opposition to doing this, which can lead to castigation or punishment. There is a response of surprise by the young person, because they do not understand the incoherence that is awakened in others by their behavior.

BIOLOGICAL BASES OF TRANSSEXUALITY

There are some neurobiological hypotheses about this human condition, however, it is not known at what point it occurs during gestation and what are the factors that condition it. Modifications in the cerebral structure of sex-gender diversity are well supported by biology and genetics. There are variations in the cerebral structures which express reproductive behaviors, especially the hypothalamus.

Veale et al.[27] reviewed previous studies of this condition. They reported that there is evidence of a genetic component of sex-gender diversity, based on studies of twins and others within the family concordance, and on studies which have specifically analyzed certain groups of genes. They also advised of evidence levels of prenatal androgens, which correlate with gender diversity, based on studies of relations of finger length (2F: 4F) of transsexual people, and of individuals who show a greater propensity to having a gender-variant or intersexual identity or syndrome, and conditions of polycystic ovary syndrome. There is also evidence that trans people have certain parts of their cerebral structure which are more similar to the atypical sex, a greater likelihood of being left-handed, a greater tendency to report childhood abuse, and in trans women, a greater number of older brothers.[27]

* For a broader sense of this concept, see "*The Selfish gene*" by Richard Dawkins.

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The relationship between the length of the first and fourth phalanges of the second and fourth finger (2F: 4F) and the inability to mentally rotate three-dimensional objects, is believed to be an indicator of elevated exposure to sexual hormones in prenatal phases.[27] The causes of left-handedness are not completely understood. There is some evidence that it is associated with an increase in levels of prenatal androgens and the development of a lack of hemispheric dominance.

The higher number of older brothers found in trans women is also reported in homosexual men. It has been proposed that each male fetus creates progressive immunization by antigens of testosterone receptors in such a way that future male fetuses have less differentiation in their brains towards virilization.[28,29] This is a mechanism of population control, where even if it is not possible to control whether the offspring is male or female, it acts epigenetically, modifying reproductive capacities.

EFFECTS OF THE ORGANIZATION OF SEXUAL HORMONES DURING EARLY STAGES OF DEVELOPMENT

Fetal gonads develop under the influence of a cascade of genes, which in male children commences with the determining gene for sex in chromosome Y (SRY).[30] The production of testosterone and the peripheral conversion of testosterone in dihydrotestosterone between weeks six and 12 of pregnancy, are essential for the formation of a boy's penis, prostate, and scrotum. However, the development of the female sexual organs in the uterus is primarily based on the absence of these androgens. Once the differentiation of these sexual organs is cancelled, the sexual differentiation of the brain takes place, due to the permanent organizational effects of the sexual hormones in the brain during development.[31] During puberty, the cerebral circuits that have been organized since gestation are activated by the sexual hormones, which emerge during this phase of the appearance of secondary sexual characteristics.

The primary mechanism responsible for gender identity and sexual orientation implies a direct effect of testosterone in the human brain during development, as demonstrated in the different types of intersexual disorders. Androgen insensitivity syndrome is caused by different mutations in the androgen receptor (AR) gene. Those affected are XY males who develop as females and have a phenotype appearance of a woman with "heterosexual" fantasies, without the problems of gender incoherence. When a male fetus has a 5-alpha-reductase-2 or 17-beta-hydroxy-steroid-dehydrogenase 3 deficiency, the peripheral testosterone becomes dihydrotestosterone. At birth, the infant presents as "female" with a large clitoris. These XY boys are generally raised as girls. However, when testosterone production increases during puberty, the 'clitoris' grows to the size of a penis, the testicles descend, and the child starts to become masculine and more muscular.

CONCLUSION

The human species is naturally organized like all other animal species. However, culture creates an order which is not natural. It is important to know the state of these topics, which due to repetition create the illusion of "normal". In his book "*La dominación masculina*" [Masculine Domination], Pierre Bourdieu[32] explains the above, stating: "there is a vision of the world with which the man (the male) quenches his thirst for dominance, a vision that women themselves (and people with sex-gender diversity), his victims, have taken on –unconsciously accepted– their inferiority". The above is accepted as inherent to our cultural forms. Bourdieu continues: "The force of the masculine order is discovered in the fact that it does without justification, the androcentric vision is imposed as neutral, and there is no need to hold discourse capable of legitimizing it. The social order functions as an immense symbolic machine that tends to ratify masculine domination in what it supports: sexual division of work, very strict distribution of activities assigned to each of the sexes (genders), of space, of time, of instruments".[32]

What this French philosopher said can be extrapolated to the sex-gender diversity group. Learning that these are natural conditions; not chosen, but nonetheless punished and persecuted by religious, political, and medical institutions, serves to place it within a different perspective. Within general evolutionary theory, there are explanations to integrate diversity, not just sex-gender diversity, but others as well, such as synesthesia, variations in character, resistance or permissiveness to confront change, resilience in the face of adversity, the ability to detect memes, and a sense of humor. We humans are a complex species, but where difference is the norm. If we do not have that perspective, we will continue to be the one-eyed kings of the blind animal kingdom.

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