SOME OBSERVATIONS ON THE DIFFICULTIES OF DETERMINING SEX

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I have had no experience in the practical problems of determining sex in athletes, and I am not even a practising geneticist; I speak from a somewhat detached viewpoint arising from a research interest in some aspects of sex differentiation. I hope, however, at least to be able to indicate how much more complicated the problem is than is generally supposed.

The division into two sexes is probably only an evolutionary device to prevent self-fertilization (only one of many possible devices, but one of the most widely used) and its importance can be exaggerated. We are conditioned to exaggerate it, and we emphasise it by external additions of clothing, behaviour and the like. The anatomical differences between a man and a woman are not much more than those between a male and a female rabbit, and who except another rabbit finds these easy to detect?

All the structures of the male and female genital tracts are present in both sexes at an early stage of development, and the final differences are the result only of more rapid growth of some parts and the suppression of others. It is easy to understand that quite minor defects in this process can give rise to indeterminate structures. It is surprising that the normal is reached so often.

Features of intersex, if we include in this all departures from normality (including those of behaviour) which represent some admixture of characteristics of the opposite sex, can probably be found in about 5% of the population. In the vast majority of these, the features of one sex are so predominant in most respects that there is no doubt as to the "pragmatic" sex, i.e. the one which on a common-sense view they can be regarded as belonging to, and in accordance with which they should be treated. Cases of real doubt are very rare. But there are various circumstances in which, if one attempts to rely too rigidly on any one criterion of sex, without taking the whole situation into consideration, one may land oneself in difficulties. The position is a good deal more complicated than it seems at first sight.

It should be realised that the attainment of full normal sexual development is a long and complex business involving several stages, any one of which can go wrong, and that the effects of disorder at the different stages can be very different. To be a fully normal male or female one needs the right chromosomes to start with, the chromosomes must induce the right gonads (ovary or testis), the gonad must produce the right hormones, the anatomical development under this hormonal stimulus

must be correct, the hormonal development at puberty must be correct, and finally the right psychological pattern of behaviour must be maintained. It is worth saying a little about each of these.

Chromosomes

The original distinction between male and female depends on the sex chromosomes. If you have two X chromosomes (XX), you are female: if you have one X and one Y (XY), a male. Quite a substantial number of people (perhaps 1 in 200 altogether) have some other combination. In general the presence or absence of a Y decided whether you are male or female, and the number of X's how nearly normal you are (with no X at all survival is impossible). Two X's and one Y produce the condition called XXY Klinefelter's syndrome: those affected are sterile, and sometimes mentally defective, but otherwise very nearly normal, and they are beyond doubt men. Presence of a single X alone produces a condition called XO Turner's syndrome: those affected are again sterile, and very short, with some minor and variable other defects, but in all common-sense aspects they are equally undoubtedly women. Here we have two examples of intersexes at the most fundamental possible level - XXY having the two X's of a female, and XO the single X of a male - yet the result in each case is a condition in which there is no doubt that they are pragmatically quite clearly male and female respectively.

(Thee X's produces a fertile female, normal except for a high tendency to mental defect, and XYY a tall male who is often a criminal psychopath, but neither of these is of course an intersex).

Mosaics: There are also very rare cases in which normal male and female cells are mixed in one individual - an XX/XY mosiac. There are two main forms of this. In one the mosaic is present from the start, and there is a genuine mixture throughout development, with parts of both male and female organs present. The results are of course bizarre and interesting. This is the most complete intersex there is, and the problem of assignment of sex is formally insoluble: but the cases are so rare that the problem is very unlikely every to be important in the present connection.

There is also a very odd variety in which twins of opposite sex change some blood cells while still in the uterus together. For the rest of their lives the cells survive, and each has some blood cells of the wrong sex, but (except that it causes extreme confusion when their blood is grouped for transfusion purposes, as they have too many groups) they are otherwise perfectly normal, and no doubt as to the real sex could possibly arise.

Sex chromatin: Counting chromosomes is laborious and difficult.

There is however a short cut method, depending on the presence of a minute body in the nucleus, which can be used to give an estimate of the number of X chromosomes present. A smear of cells from the inside of the mouth is used: it is the only method that could be used for any kind of quick screening on a lot of people. Since it only counts X chromosomes, it can be misleading: and XXY Klinefelter's syndrome emerges as a woman, an XO Turner's as a man on this test. This test is a valuable guide to the need for further investigation, but it cannot be assumed that because the result is anomalous that the person concerned is not of the sex to which he or she claims to be.

Gonads

Usually the gonads are determined by chromosomes. But rarely, under circumstances not yet understood, the process appears to be disturbed. The most important of these are cases in which two different gonads, or parts of gonads, are produced - i.e. both ovary and testis in one person. This, so called "true Hermaphroditism" or amphigonadism, produces an effect like the first of the two kinds of XX/XY mosaic already described: again the problem of assignment of sex is strictly insoluble, but the cases are exceedingly rare.

Hormones

The sex hormones mostly depend on the gonad, but the process sometimes goes wrong. Two of the variants are worth describing, both hereditary dis-orders in which several cases may be found in one family. The commonest is adrenal virilism, in which the chemistry of the adrenal gland is at fault, so that the gland produces male hormones instead of normal adrenal hormones (many of the hormones, it should be remembered, are chemically closely related to each other and manufactured in the body by variations of the same chemical process). The effect is to produce, at birth and later, a varying degree of masculinization, sometimes enough to lead to a wrong diagnosis of sex as male. It is an important disease, especially since it can be very effectively treated if recognised in time. However, the affected women suffer from the absence of the normal adrenal hormone, it untreated, and it is unlikely that they ever become athletes.

The other hormone disorder I want to mention is testicular feminization, rarer than adrenal virilization but not rare enough to neglect altogether, and a remarkable example of the difficulties than can be met with. In this condition, though the chromosomes are XY and testes are present, there is some inborn defect of the hormone chemistry (the details not yet worked out) which leads to feminization and the external appearance of a very nearly completely normal woman. Such a person is male by several, normally very reliable laboratory tests: yet pragmatically she is a woman, often an attractive woman capable of happy marriage (though not of bearing children) and one to whom any attempt at changing the sex or even to suggest that the sex ought to be changed could be disastrous

Anatomy

Chromosomes, gonads and hormones may be right, but the anatomical development that should occur in response to them may be defective. The male anatomy is the more delicate plant, and defects in the male genitalia commoner than female. Most of these are of minor importance, but just occasionally extreme maldevelopment of the external genitalia may lead to the misdiagnosis of sex at birth. It must, however, be exceedingly rare for this misdiagnosis not to be corrected during infancy. The condition rejoices in the name of "male pseudohermaphroditism".

Changes after birth

Various things can happen after birth which may in some degree feminize a male or masculinize a female - drug treatments, for instance, or the development of hormone-producing tumours. But the changes never amount to a true sex reversal, and they do not really concern us here.

Behaviour

There are two main intersexual behaviour disorders, both commoner, or at least more often recognised, in males. Homosexuality, the more frequent, does not concern us. Transvestitism may. The compulsive desire to wear the garments of the opposite sex may occasionally take extreme forms, with drugs, surgery and legal declarations called in to aid the completest possible change of appearance and identity. If a male transvestite could establish legal status as a woman his (or her) status as an athlete could raise some difficult problems.

SUMMARY AND CONCLUSIONS

(a) Since to be a successful athlete requires a normal body, intersexes are likely to be rarer among them than in the general population.

(b) In most cases the pragmatic sex is what matters, and no matter what the laboratory findings this should be accepted. The only generally valid exceptions for athletic purposes (apart from plain deception) should be transvestitues and male pseudohermaphrodites, and in both cases it is only the rare and extreme degrees that are likely to cause any difficulty at all. The borderline between deceit and transvestitism might be hard to draw.

(c) The interest of the individual must be considered. It could be a psychological disaster for some women to have their sex question on the basis of a laboratory test. If routine tests are necessary, they must be administered not only with skill and full knowledge, but also with humanity.

(d) Male hormones, or other anabolic steroids, given to a woman once she is past puberty will not in any sense change her sex, though they may cost her some feminine graces. But this is part of the general problem of influencing athletic prowess by drugs, and is not really concerned with the sex of the athlete.

DISCUSSION

Bearing in mind that the whole question of sex determination in sport hinged on women's athletics, Dr Moncur asked whether a pragmatic female could be altered by the use of anabolic steroids.

Professor Lennox said that there was no categoric answer but it was possible that anabolic steroids could have an effect in certain causes, although he found it difficult to visualise the situation where drugs of this nature would be administered without a medical reason.

Dr. Skirving asked whether anabolic steroids would make any difference from a medical standpoint and not in relation to performance in sport, to a normal man or woman.

Professor Lennox replied that this raised the whole question of what was normal and what was abnormal, but briefly he considered anabolical steroids would make no difference.

Mr. Anderson asked Professor Lennox if he considered that to distinguish between a male and a female as in the case of the Polish girl recently disqualified from competition was wrong.

Professor Lennox stated that if a case arose where tests revealed that a woman had some chromosome abnormality, then obviously there must be a thorough investigation but to state categorically, without further evidence, that she is not a woman was wrong.

Mr. Logan asked if chromosome abnormality was sufficient to determine sex.

Professor Lennox stated that this was dangerously oversimplifying the complex question of sex determination.

Dr. Black said that undoubtedly physical examination and smear test was not sufficient to determine sex but this was the case in athletics today.

Mrs Sinclair said that, while appreciating the complex medical issues involved, it could not be ignored that in athletics today drugs were administered solely to improve performance and if a woman with abnormal sex chromosome structure could and, perhaps, would have improved performance over a normal female, then she could have an unfair advantage over other competitors.

Professor Lennox said that he realised this was a very difficult problem in relation to women's athletics, but emphasised strongly that, in his opinion, on the basis of the present tests to state categorically that someone who had been brought up as a woman, acted and thought as a female, was in fact not a woman, was wrong.

Dr. Browning said that he felt certain Professor Lennox had opened the delegates' eyes to the complexity of the issue, to the great difficulties involved in the determination of sex and to the considerable danger of over simplification. The question, particularly in relation to women's athletics and the possible effects of administered drugs, would require considerable research in the years to come before a satisfactory conclusion was reached, if indeed it were possible ever to reach a completely satisfactory conclusion.