

## POPULATION DIFFERENCES IN SUSCEPTIBILITY TO AIDS: AN EVOLUTIONARY ANALYSIS

J. PHILIPPE RUSHTON and ANTHONY F. BOGAERT

Department of Psychology, University of Western Ontario, London, Ontario N6A 5C2, Canada

**Abstract**—Previously we have reported population differences in sexual restraint such that, higher socio-economic status > lower socio-economic status, and Mongoloids > Caucasoids > Negroids. This ordering was predicted from a gene-based evolutionary theory of  $r/K$  reproductive strategies in which a trade-off occurs between gamete production and social behaviors such as intelligence, law-abidingness, and parental care. Here we consider the implications of these analyses for sexual dysfunction, including susceptibility to AIDS. We conclude that relative to Caucasians, populations of Asian ancestry are inclined to a greater frequency of inhibitory disorders such as low sexual excitement and premature ejaculation and to a lower frequency of sexually transmitted diseases including AIDS, while populations of African ancestry are inclined to a greater frequency of uninhibited disorders such as rape and unintended pregnancy and to more sexually transmitted diseases including AIDS.

**Key words**—Africa, AIDS, evolution, race, sexuality

### EPIDEMIOLOGY

The current HIV-1 pandemic started during the mid-1970s but was not recognized until 1981 when it was labeled the acquired immunodeficiency syndrome (AIDS). As Mann and Chin [1] describe, the discovery of the HIV-1 virus in 1983, and wide availability of diagnostic assays for antibodies to HIV-1 since 1985 have led to a picture of the worldwide extent and distribution of the disease. As of 1 July 1988, a total of 100,410 cases of AIDS had been reported to the World Health Organization (WHO) from 138 countries—45 in Africa, 40 in the Americas, 28 in Europe, and 25 in Asia and Oceania. Taking into account underreporting and inherent delays in manifestation, Mann and Chin estimate that there has been a cumulative total of 250,000 cases of AIDS to date and that 5–10 million persons are infected with HIV-1 worldwide.

While the modes of transmission are universally the same—through sex and blood and from mother to fetus—the virus has entered and spread within various populations and subpopulations at different times and rates. Both intra-national and international epidemiological studies reveal that for AIDS and HIV-1 seroprevalence, Mongoloids < Caucasoids < Negroids [1–5]. While the reporting of AIDS cases from Africa and the Caribbean has been delayed, partly due to the reluctance of many governments until 1987 to officially acknowledge their existence [6, 7], it has now become clear that relative to other populations these predominantly Negroid countries have an enormous AIDS problem with up to 25% of the 20–40-year age group in some urban areas infected (including women of childbearing age), and with up to 90% of the female prostitutes seropositive [1, 4, 5, 8]. A new AIDS related virus, HIV-2, has also been isolated in West Africa where estimates

of the seroprevalence rate in the general population range from 0.3 to 17%, with up to 64% of prostitutes being seropositive [4].

In African and Caribbean countries the AIDS virus is transmitted predominantly through heterosexual intercourse (Fig. 1). The age and sex distributions of HIV infection rates is similar to that of other sexually transmitted diseases (STDs) with higher prevalence among younger sexually active women [4, 5, 8]. At the other extreme, it is a characteristic feature of AIDS in China and Japan that most sufferers are hemophiliacs [5], accounting, for example, for 34 of Japan's 59 officially confirmed AIDS patients [9]. The Japanese Ministry of Health and Welfare estimates that about 40% of Japan's hemophiliacs, or 2000 people, are infected with the AIDS virus. The prime infection route is strongly suspected to have been blood plasma imported from the United States for manufacture of blood coagulants [5, 9]. An intermediate amount of HIV infection is apparent in Europe and the Americas where to date it has occurred predominantly among homosexual men and intravenous drug abusers [1, 4, 5], although now may be breaking out into the heterosexual population in several countries, including Belgium [10], Cuba [11] and the U.S.A. [12, 13].

A pattern of whites being intermediate to black and Oriental populations is also found *within* the United States (Fig. 2). As of 4 July, 1988, while blacks amount to less than 12% of the U.S. population they disproportionately account for 26% of adult and 53% of pediatric AIDS cases [3, 14]. Whites amount to over 80% of the population and account for 59% of adult and 23% of child AIDS cases, with Hispanic populations being intermediate [3, 14]. Oriental populations do not exist in the AIDS figures, including those from California and Hawaii. Confirmation of the U.S. racial pattern is found from the results of testing more than 1.2 million military applicants and blood donors. These studies show that black and Hispanic applicants have HIV-1 seroprevalence rates

This paper was completed while the first author was a Fellow of the John Simon Guggenheim Memorial Foundation.

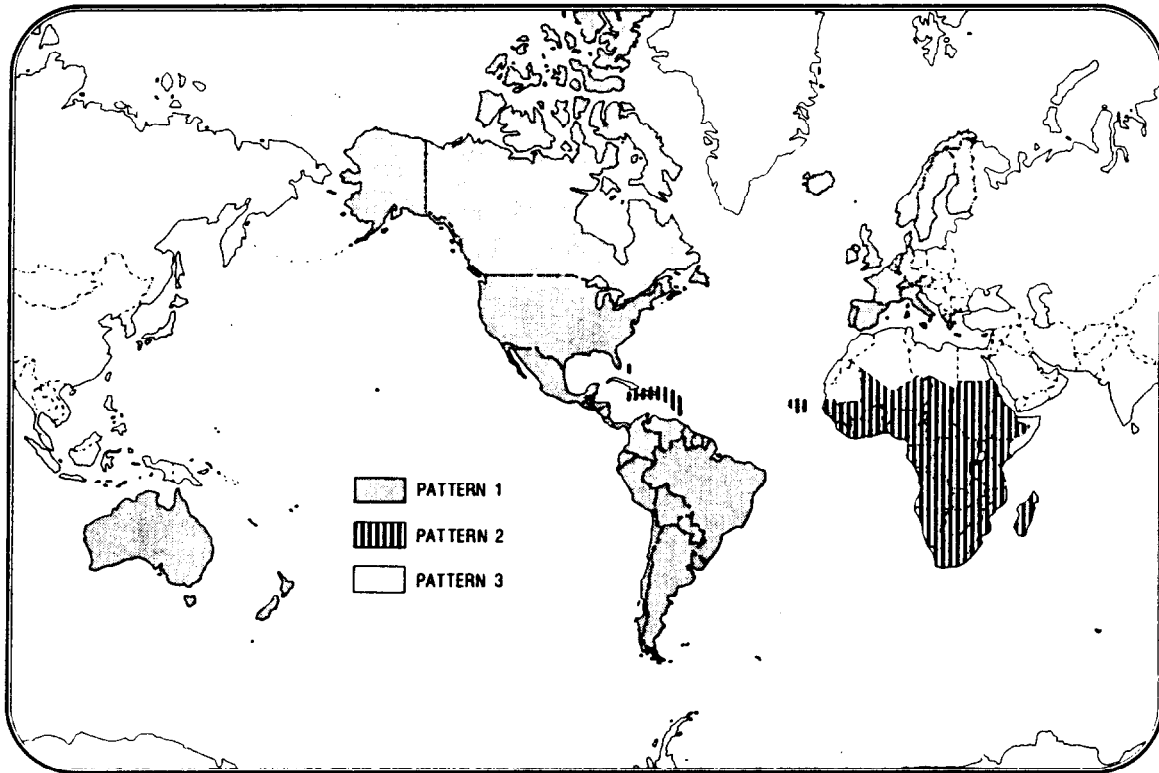


Fig. 1. Three infection patterns of the AIDS virus are apparent worldwide. Pattern 1 is found in North and South America, Western Europe, and Australasia where 90% of the cases are homosexual males or users of intravenous drugs. Pattern 2 is found in Africa and the Carribean where the primary mode of transmission is heterosexual sex and the number of infected females and males is approximately equal. Pattern 3 is typical of the rest of the world where relatively few cases have been reported [4, 5].

three to ten times higher than white applicants [3]. Blood samples taken from umbilical cords after birth in inner city (black) rather than suburban (white) hospitals confirm the differentials. In some areas of New York City and Boston, 1 in 60 babies is born with AIDS antibodies [15].

The AIDS epidemic is considered by many to have originated in Africa [4-7, 16, 17], from where it spread worldwide (Fig. 3), as will be discussed shortly. Evidence for the African origin arises from several converging sources. First, more HIV-related viruses are found in African primates, a possible

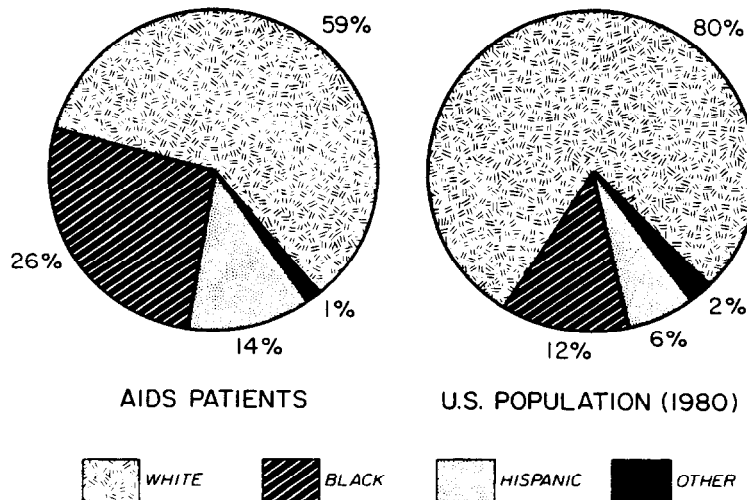


Fig. 2. Racial and ethnic classification of U.S. adult AIDS cases shows a disproportionate fraction of them among blacks and Hispanics. The figures reflect the higher reported rates of AIDS in black and Hispanic intravenous drug abusers and their sex partners [14].

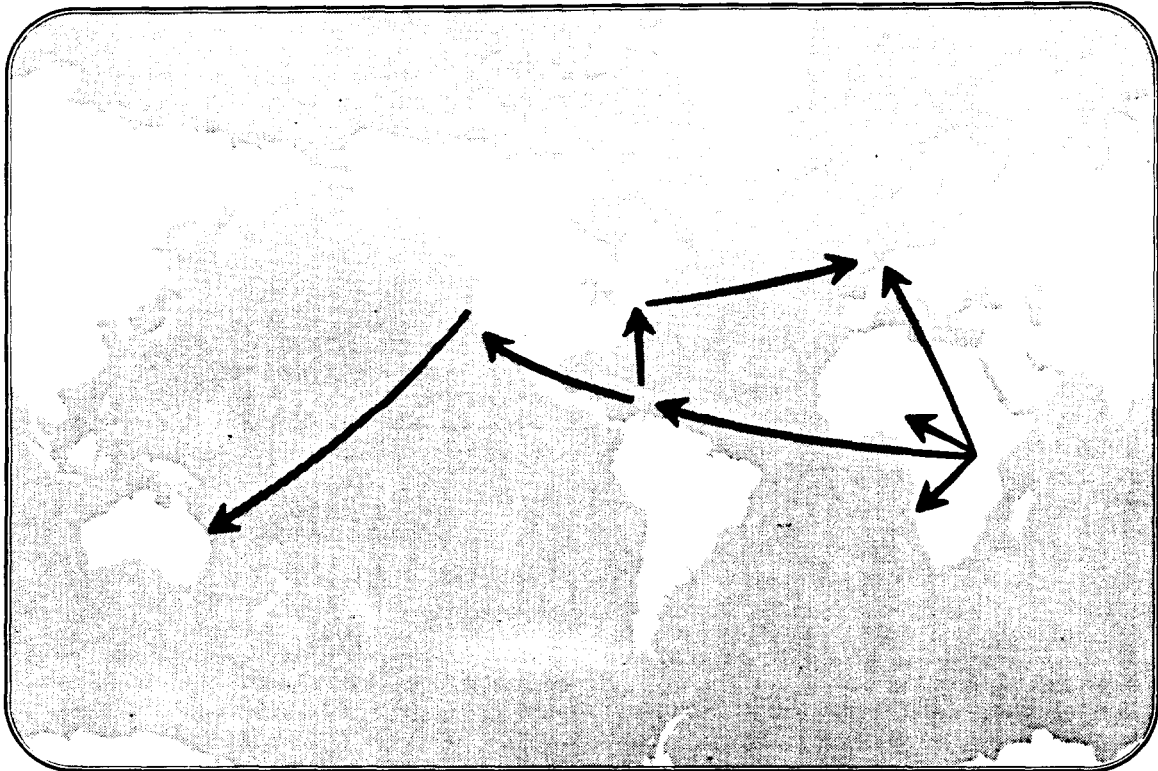


Fig. 3. Probable origin and spread of the AIDS virus worldwide [16].

origin of the human virus, than in Asian species. Their long standing existence is shown, for example by the African green monkey having evolved mechanisms to keep the pathogen from causing disease, a process taking many generations. The virus wreaks havoc in newly exposed Asian monkeys [18].

Other evidence for an African origin is that the HIV-1 virus has been found in blood stored from 1959 in Zaire but not from blood stored at that time in Europe or North America [4, 8]. From the late 1960s and early 1970s, serum samples originating in Africa have been found to show a high incidence of seropositivity. No serum samples stored in the United States prior to 1978 have been found to be seropositive. Moreover, isolates of HIV-1 from Africans appear more heterogeneous genetically and antigenetically compared with isolates from Europeans and Americans [19], with novel forms, such as HIV-2, being discovered [20]. Variation is generally greater the earlier the genetic origin. Judging by its strain diversity, some estimate that it may have been in the African population for between 25 and 100 years [21].

Retrospective diagnostic studies provide additional evidence for the African origin. A marked increase of AIDS indicator diseases (chronic diarrhea, and generalized Kaposi's sarcoma) was diagnosed in Central Africa in the late 1970s where AIDS had been known locally as 'slim' disease [8]. Isolated cases of AIDS in Africans have also been retrospectively diagnosed in Europe in the 1970s [4]. Cases retrospectively diagnosed as AIDS were also recorded in Haiti before the U.S.A., and this may have been due to the fact that migrant Haitian workers spent periods of time in

Central Africa in the 1960s and 1970s (see Fig. 3, Ref. [16]). In the 1970s Haiti was popular as a holiday resort for homosexual men from the U.S.A. [16]. Subsequently many homosexual patients in Europe and Australasia appear to have contracted their infection in the U.S.A. HIV-2 now seems to be spreading from West Africa to Central Africa, Europe and to the United States [4]. One noted transmission route from Africa to the Western Hemisphere may be via the large number of Cuban military and health care advisors, some of whom became refugees in the U.S. [11].

#### RACIAL DIFFERENCES IN SEXUAL BEHAVIOR

This is the third paper in a series we have written on racial differences in sexual behavior. In our first, we reviewed differences in sexual restraint such that Orientals > whites > blacks [22]. Restraint was indexed in numerous ways having in common a lowered allocation of bodily energy to sexual functioning. We found that the same racial pattern occurred with gamete production [dizygotic (two egg) twinning frequency per 1000: Mongoloids <4; Caucasoids 8; Negroids >16], intercourse frequencies (premarital, marital, extramarital), developmental precocity (age at first intercourse, age at first pregnancy, number of pregnancies), primary sexual characteristics (size of penis, vagina, testis, ovaries), secondary sexual characteristics (salient voice, muscularity, buttocks, breasts), and biologic control of behavior (periodicity of sexual response, predictability of life history from onset of puberty), as well as in androgen levels and sexual attitudes.

Table 1. Proportion of population aged 11–21 experiencing premarital coitus [22, 23]

Population	Percentage sexually experienced		
	Males	Females	Combined
Asians	12	5	9
Europeans	46	35	40
Africans	74	53	64

Consider, for example, the estimates of intercourse frequency in marriage where, for couples in their 20s, the average frequency per week approximated: for Orientals, 2; for whites, 4; and for blacks 5. Consider also the percentage of adolescents who reported themselves to be sexually active. We categorized the 27 countries from a World Health Organization Study of the extent of premarital coitus among young people from around the world [23] by primary racial composition and averaged the figures. As can be seen in Table 1, the results showed that African adolescents are more sexually active than Europeans who are more sexually active than Asians. While some variation occurred from country to country, consistency was found within groups. Thus Koreans and Japanese were similar to each other and different from Israelis, Swedes, and white Americans, who, in turn, were similar to each other but different from Kenyans, Nigerians, and black Americans. As is typical of such surveys, young men report a greater degree of sexual experience than young women [24]. It is clear from Table 1, however, that the population differences are replicable across sex, with the men of the more restrained group having less experience than the women of the less restrained. A confirmatory study was carried out in Los Angeles which held the setting constant and fully sampled the ethnic mix [25]. Of the 594 adolescent and young adults sampled, 20% were Oriental, 33% were white, 21% were Hispanic, and 19% were black. The average age at first intercourse was 16.4 for Orientals and 14.4 for blacks, with whites and Hispanics intermediate, and the percentage sexually active was 32% for Orientals and 81% for blacks, with whites and Hispanics intermediate.

In the second study we examined whether the racial differences in sexual behavior were more pronounced than those associated with socio-economic status (SES). Many commentators attribute racial differences to SES [26], and SES differences in sexual behavior have been observed to parallel the racial differences [27]. To investigate the issue, therefore, we analyzed data from the Kinsey Institute for Sex Research and found that, in terms of sexual restraint, college-educated whites > noncollege-

educated whites > college-educated blacks on measures such as speed of occurrence of premarital, marital, and extramarital sexual experiences, number of sexual partners, frequency of intercourse, speed and incidence of pregnancy, and rapidity of the menstrual cycle [28]. These results have been confirmed by Weinberg and Williams [29] who reanalyzed evidence from three independent sources: the original Kinsey data which formed the basis of our studies; a 1970 National Opinion Research Center poll of sexual attitudes; and a study carried out in San Francisco. All three reanalyses showed the predicted racial effects on sexuality while holding education and social class constant. As such the data suggest that race is a more powerful predictor of sexual behavior than educational level or social class.

#### RACIAL DIFFERENCES IN $r/K$ REPRODUCTIVE STRATEGIES

The pattern of racial differences in sexual behavior had been predicted from an evolutionary theory of  $r/K$  reproductive strategies in which a trade-off that exists between egg production and parental care is postulated to underlie a suite of life history attributes [30–35]. At the  $K$  end of the continuum organisms produce very few offspring but invest a large amount of care in each. At the  $r$  end, organisms produce a large number of offspring but provide little or no parental care. As can be seen in Fig. 4, oysters producing 500 million eggs a year exemplify the  $r$ -strategy, while the great apes, producing only one infant every 5 or 6 years, exemplify the  $K$ -strategy.

Evidence from comparative studies and selective breeding experiments on species ranging from dandelions to fish to mice to men, indicates that these reproductive strategies are correlated with other features of the organism's life history [34]. These are summarized in Table 2. It can be seen that, in terms of *Family Characteristics*,  $r$  and  $K$  strategists differ in terms of litter size (number of offspring produced at one time), birth spacing, total number of offspring, rate of infant mortality, and degree of parental care. In regard to *Individual Characteristics*,  $r$  and  $K$  strategists differ in rate of physical maturation, sexual precocity, life span, reproductive effort, energy use, and intelligence. Finally, in terms of *Population and Social System Characteristics*, they differ in their treatment of the environment, the stability of their population size, their ability to compete under scarce resources, and their degree of social organization and altruism.

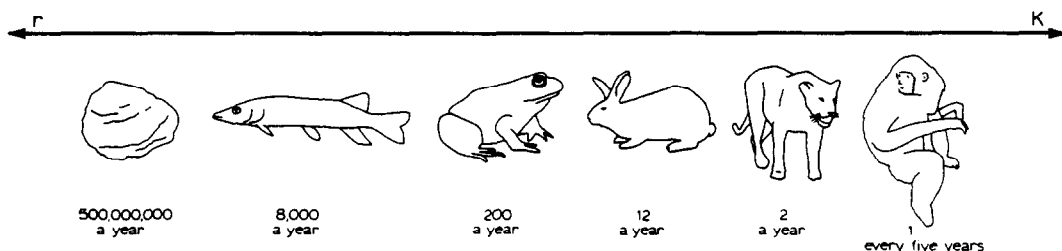


Fig. 4. The  $r/K$  continuum of reproductive strategies balancing egg output with parental care [32].

Table 2. Some life history, social behavior, and physiological differences between *r*- and *K*-strategies [34]

<i>r</i> -Strategist	<i>K</i> -Strategist
<i>Family characteristics</i>	
Large litter size	Small litter size
Short spacing between births	Long spacing between births
Many offspring	Few offspring
High rate of infant mortality	Low rate of infant mortality
Low degree of parental care	High degree of parental care
<i>Individual characteristics</i>	
Rapid rate of maturation	Slow rate of maturation
Early sexual reproduction	Delayed sexual reproduction
Short life	Long life
High reproductive effort	Low reproductive effort
High energy utilization	Efficient energy utilization
Low intelligence	High intelligence
<i>Population characteristics</i>	
Opportunistic exploiters of environment	Consistent exploiters of environment
Dispersing colonizers	Stable occupiers of habitat
Variable population size	Stable population size
Competition variable, often lax	Competition keen
<i>Social system characteristics</i>	
Low degree of social organization	High degree of social organization
Low amounts of altruism	High amounts of altruism

Primates are all relatively *K*-strategists, and humans are the most *K* of all. As depicted in Fig. 5, the order primates display a natural scale going from lemur to macaque to gibbon to chimp to humans, in which there is a consistent trend toward *K* with progressive prolongation of gestation periods and life phases [35]. Note the proportionality of the four indicated phases. The postreproductive phase is restricted to humans. With each step in the natural scale, populations devote a greater proportion of their reproductive energy to subadult care, with increased investment in the survival of offspring.

As a species, humans are at the *K* end of the continuum, although some people are postulated to be more *K* than others [30]. The more *K* a person is, the more likely he or she is expected to come from an intact family, with more intensive parental care, with fewer and more widely spaced offspring, and with a lower incidence of multiple birthing and infant mortality. *K*s are expected to have a longer gestation period, a higher birthweight, a more delayed sexual maturation, a lower sex drive, and a longer life. Moreover, the *K* person is inclined to be more intelligent, altruistic, law-abiding, and behaviorally

restrained [30]. Thus diverse organismic characteristics, not otherwise relatable, are presumed to covary along the *K* dimension. Evidence for the expected covariation among the *K* attributes has been provided [30-41].

Racial differences in *r/K* sexual strategies were predicted because human populations are known to differ in egg production. While the monozygotic twinning rate is nearly constant at about 3.5/1000 in all groups, the rate per 1000 of dizygotic twins (the *r*-strategy, caused by the production of two eggs at once, see Ref. [39]), among Mongoloids is 4, among Caucasoids, 8, and among Negroids, 16, with some African populations having rates as high as 57/1000 [42]. Moreover, the pattern of racial differences observed to occur in sexuality has also been found on numerous other indices of *K*. Across ages, samples, countries, and time periods, measures made of health (infant mortality, illness, longevity), brain size and intelligence (cranial capacity, brain weight, test scores), maturation rate (age to hold head erect, age to walk alone, age of death), social organization (marital stability, mental disorder, law-abidingness), and temperament (activity level, anxiety, sociability), all suggest that, on average, Mongoloids are more *K* than Caucasoids, who, in turn, are more *K* than Negroids [40, 41]. These findings are summarized in Table 3.

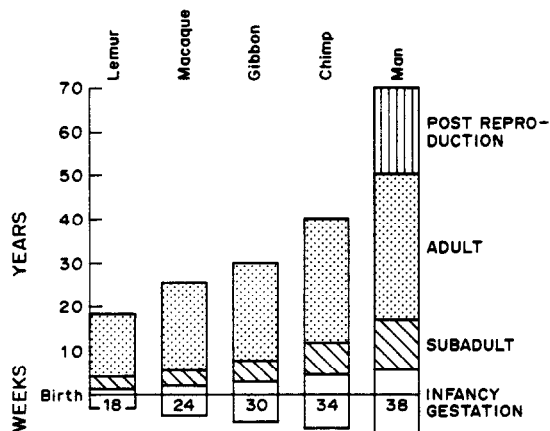


Fig. 5. Progressive prolongation of life phases and gestation in primates [35].

#### IMPLICATIONS OF *r/K* STRATEGIES FOR SEXUAL DYSFUNCTION

The racial differences in sexual behavior translate into consequences. It is well established that teenage fertility rates in both developed and developing countries show the expected ranking of black > white > Oriental [23, 43]. The racial differences in sexuality also manifest themselves in psychological phenomena. In Ford and Beach's survey [44], Oriental groups were the most likely to endorse beliefs concerning the weakening effect of intercourse. A review by Vernon led him to conclude that both the Chinese and the Japanese were not only less experienced in premarital sex, but were also less permissive and less concerned

Table 3. Ranking of populations on  $r$   $K$  associated attributes [40, 41]

	Mongoloids	Caucasoids	Negroids
<i>Brain weight and intelligence</i>			
Cranial capacity	1448 cm <sup>3</sup>	1408 cm <sup>3</sup>	1334 cm <sup>3</sup>
Brain weight at autopsy	1351 g	1336 g	1286 g
Millions of 'excess neurons'	8900	8650	8550
IQ test scores	107	100	85
<i>Maturation rate</i>			
Gestation time	?	Medium	Fast
Skeletal development	?	Medium	Fast
Age of walking	Slow	Medium	Fast
Age of first intercourse	Slow	Medium	Fast
Age of first pregnancy	Slow	Medium	Fast
Brain weight decline begins	Age 35	Age 25	?
Life-span	Long	Medium	Short
<i>Personality and temperament</i>			
Activity level	Low	Medium	High
Aggressiveness	Low	Medium	High
Cautiousness	High	Medium	Low
Dominance	Low	Medium	High
Impulsivity	Low	Medium	High
Sociability	Low	Medium	High
<i>Reproductive effort</i>			
Multiple birthing rate	Low	Medium	High
Size of genitalia	Small	Medium	Large
Secondary sex characteristics	Small	Medium	Large
Intercourse frequencies	Low	Medium	High
Permissive attitudes	Low	Medium	High
Sexually transmitted diseases	Low	Medium	High
Androgen levels	Low	Medium	High
<i>Social organization</i>			
Law abidingness	High	Medium	Low
Marital stability	High	Medium	Low
Mental health	High	Medium	Low

with sexual display than Caucasians [45]. Other studies find similar relationships with measures made of frequency of sexual fantasy: whereas 52% of British female university students 'think about sex everyday', only 1% of Japanese female students did so [46].

It has been argued that, within the constraints allowed by the total spectrum of cultural alternatives, people create norms and environments maximally compatible with their genotypes [47, 48]. This would explain why in China and Japan clothing styles have often been chosen to flatten the breasts and buttocks in an explicit attempt 'to deanimalize' [49, p. 107], with an opposite clothing style often chosen in Africa [49]. Moreover, in Africa dances have been invented which emphasize undulating rhythms and mock copulation. Underlying dispositions affect many aspects of lifestyle, including smoking and dietary preferences, friendship and mate choice, and vocational and leisure pursuits. Thus even ostensibly 'environmental' influences may have a genetic component [50].

#### *Inhibited sexuality*

Although good epidemiological data are not available with respect to the distribution of relatively inhibited and antihedonic sexuality, the evidence inclines to the view that the more  $K$  dominated cultures and populations are less prosexual than the less  $K$ . Money [51-53] provides several examples. North European cultures, for example, have often invented antimasturbatory and antisexual ideologies. The Victorian ideals originating in the early eighteenth century, aimed at total abstinence or, if married, extreme continence [51, 52]. Graham Crackers, Kellogg's Cornflakes, Granola,

and other breakfast cereals began as health foods aimed at preventing masturbation and 'sexual degeneracy'. It was argued that good food, physical fitness and sexual abstinence would help the individual resist disease, including the deadly cholera epidemic. Much of the emphasis against sex derived from a belief in the weakening effects of the loss of semen.

Oriental populations have long held beliefs in the weakening effects of semen loss. Physically or psychiatrically ill Chinese patients often refrain from sexual intercourse for fear that the loss of semen may further impair their health, beliefs which date back to Taoist physicians 2000 years ago [54]. In a review of sex therapy in Britain, it was found that while sex-stress led to premature ejaculation amongst Asian patients, this problem was virtually absent among blacks [55]. An unusual 'inhibited' disorder, *Koro*, meaning turtle's head, refers to a phobic reaction in which, with increasing age, patients fear that their penis is shrinking [53]. Although isolated cases have been found from countries throughout the world, it is more prevalent in China and other Asian countries.

#### *Uninhibited sexuality*

Rape is considered one of the most serious of criminal offences. Oriental populations are completely underrepresented in such crimes, as they are in crime generally, both as perpetrators and as victims [56]. Although some of the arrest statistics may be biased against blacks, the figures do show that blacks are substantially overrepresented in such crimes. In the United States blacks are about one-eighth of the population but accounted, in 1980, for about one-half of all those arrested for rape [56]. Among U.S. adolescents the overrepresentation of blacks in crime is most marked for sexual offences

[57]. Across all criminal offences in 1980 and 1981 committed by adolescents, 24% of the offenders were black; for sexual offences, however, 35% were black; for forcible rape, 58% were black. Black sex offenders, compared to white sex offenders, are also more likely to use force in the commission of the offence and to engage in vaginal intercourse with their victims [58]. Often the victims of sexual assault are also black: a large study carried out in Philadelphia on the sexual abuse of children aged 2–12, showed that 82% were black and 18% were white [59].

The prevalence of sexually transmitted diseases (STDs) in different populations provides another estimate of under-controlled behavior. The data is consistent in showing that for a range of STDs, Orientals < whites < blacks. The World Health Organization Technical Report [60], for example, examined the world wide prevalence of syphilis, including congenital syphilis, finding very low levels in China and Japan, and very high levels in Africa, with European countries intermediate. Other studies find comparable results [61–65]. Africa is known to be differentiated from other areas of the world in having STDs as the major cause of infertility [61]. At the other extreme, claims have been made that the People's Republic of China has virtually eradicated venereal disease through the elimination of prostitution and the presence of occupying soldiers [62]. Similarly the incidence of STDs such as herpes in Tokyo, Japan, is one-tenth of the incidence in Western countries [64]. The racial pattern found worldwide in STDs is also found *within* the United States. Thus U.S. blacks have substantially larger amounts of syphilis [66], including congenital syphilis [67], gonorrhoea [68], and hepatitis B [69] than do U.S. whites.

#### IMPLICATIONS FOR SUSCEPTIBILITY TO AIDS

Populations made up of less  $K$  individuals may be particularly susceptible to AIDS for a variety of related reasons (see Tables 1–3 for review). Most obvious will be that the less  $K$  individuals will be drawn to have sexual coitus with more numerous partners. As reviewed above, with marital intercourse during the early 20s, surveys indicate that Oriental populations have a mean intercourse frequency 50% lower than whites, while black populations have one 25% higher; and whereas only 30% of white university students in the U.S. have had intercourse with prostitutes, 50% of black university students have [22]. Similarly, actual and future-expected extramarital intercourse is about double in black university graduates than in whites. Since most of these surveys are based on atypical black populations (the most elite), it is likely that they are underestimates of the real black–white differences [28]. For example, more than a five-fold difference is found in the range of sexual activity between white students and white nonstudents attending an STD clinic in Arizona, and for white and black heterosexuals aged 26 attending the STD clinic, the number of lifetime partners for whites is 29, while for blacks it is 42 [69].

That number of sexual partners leads to a risk of AIDS is shown by its clear relation to other STDs

[70], as well as to AIDS itself [8, 71]. For example, in Africa, studies have found that one-third of AIDS patients reported having at least one sexually transmitted disease during the 3 years preceding their illness [8]. As reviewed above, the races differ substantially in current prevalence of STDs. Many studies in sub-Saharan Africa strongly reinforce the supposition that frequency of sexual contact is the primary factor governing the transmission of HIV there [5].

Sexual precocity also differentially inclines the populations to risk of AIDS. Many studies have reported that in speed of sexual experience and pregnancy, blacks > whites > Orientals. One U.S. survey, for example, found that 60% of 11-year-old black boys had reached the stage of accelerated penis growth in contrast to the white norm of 50% of 12.5-year-olds [72]. This genital stage significantly predicted onset of sexual interest, with 2.2% of the black boys experiencing intercourse by age 11. While some surveys find that Oriental girls enter puberty as early as whites [73], others suggest that in both physical development and onset of interest in sex, the Japanese, on the average, lag 1.5–2 years behind their American counterparts [74]. In Rushton and Bogaert's analyses of the Kinsey data, black respondents, compared to white respondents, left home earlier, experienced a variety of premarital, marital, and extramarital sexual events earlier, and had a greater incidence of pregnancy at a faster rate [22, 28].

Lowered levels of intelligence must also be considered a risk factor. Observation of contingent danger may be less, both in terms of acquiring the disease, and in transmitting it to others. There are many problems in Africa in educating people to avoid intercourse with prostitutes, or other at-risk behavior such as scarification, tattooing, ear piercing, male or female circumcision, blood-brotherhood ceremonies, etc. [8]. In the U.S. it is becoming clear that drug addicts who actively seek out heroin with street 'brand names' such as 'death wish' and 'suicide' are not likely to readily modify their at-risk behavior [74]. It is conservatively estimated that there are 100,000 addicts in New York alone who carry the AIDS virus [74], and in some samples, seroprevalence among Afro-Americans has soared to African proportions [3, 74]. Voluntary self-exclusion from blood transfusion services and from promiscuous intercourse seems unlikely.

Social organizational capacity appears to differentiate the races and to be a salient feature of groups differing in  $K$ . Less  $K$  populations generate decentralized organizations with weak power structures in which the important lines of communication are perceived to be the face-to-face ones, in contrast to  $K$  generated centralized hierarchies in which internal communication networks are highly regulated [75]. It is widely accepted that organizational problems are one of the impediments operating in Africa [8]. At the opposite extreme, China has been able to implement for one-quarter of the world's population, a single-child family within one generation (along with, as mentioned, the virtual eradication of venereal disease). The quick marshalling of self-help groups in response to the AIDS threat in the white middle-class

homosexual community of San Francisco has similarly been contrasted with the lack of organization among black intravenous drug users in New York [74].

Stable social organization also depends on individuals adhering to rules, a construct which can be indexed through marital functioning, mental durability, and law abidingness. Marital stability, for example, can be assessed by rate of divorce, out of wedlock birthing, child abuse, and delinquency. On each of these measures, the rank ordering within the U.S. population is Mongoloid > Caucasoid > Negroid [40, 76]. Moreover, in other parts of the world there is evidence that the impact of migration and technological development has detrimentally affected African social structure more than European, and European more than Oriental [76-78].

#### DISCUSSION

The ultimate aim of science is causally to explain the world around us, rather than only to describe it. The *r/K* theoretical framework orders much of the data reviewed, along with its patterning and its heritable nature. One objection that may be made to the account that we have presented concerns the nature of causality. Many will want to argue that the differences that have been observed are due to cultural, socio-economic and other environmental factors, and that the diffusion of AIDS has more to do with communication networks than with levels of sexual activity in ethnic groups. Certainly many factors are involved and we are not advocating an exclusive theory. We are aware, for example, of the evidence for socialization effects on many of the variables. Within the United States black males learn early that assertive sexuality and sexual prowess are means of gaining status as well as gratification [79, 80], while in Oriental populations restraint is generally valued [45]. Such explanations, however, do not order the data on the physical variables such as the duration of the menstrual cycle, the size of the penis, nor the worldwide differences in dizygotic twinning rate [39, 42]. Nor do they take into account the evidence that many of the variables, including strength of the sex drive [81, 82] and the tendency to double ovulate [42] are found to be heritable. From the *r/K* perspective, the fact that across populations gamete production correlates negatively with brain size and that both covary with the suite of life-history variables shown in Table 3, as well as dovetailing with evolutionary theory and the behavior of other animals [30-35] makes it reasonable to suggest that the racial group differences in susceptibility to AIDS belong in a broader perspective than has been considered to date.

The importance of culturally influenced diffusion networks is not to be denied (Figs 1 and 3). These may be expected to interact, however, with genetically based dispositions. An example of such interlacing from an *r/K* perspective comes from examining male versus female differences in transmission rates of AIDS among white homosexuals. These differentials are understandable from an analysis of the cultural norms generated from underlying male/female differences in sexual preferences [24]. When

the necessities to compromise required by the presence of the opposite sex are removed, males and females are freer to construct those behavior patterns most compatible with their genotypes. Thus homosexual male culture is typically *r*-like and promiscuous, often involving large numbers of sexual partners in a detached manner and emphasizing youthful attractiveness. Female homosexual culture, on the other hand, is more typically *K* like, emphasizing stable, long-term monogamous relationships with a supportive set of social norms.

If the analysis presented here is correct, several predictions are possible about the future global pattern of the pandemic. Of those countries which have still to report sizeable AIDS cases, or otherwise where the epidemiology is not yet known, we would predict the virus to spread most in the more *r*-strategy groups. For example, in racially diverse Caribbean countries such as Guyana and Trinidad, East Indians are predicted to equal whites (both are Caucasoid samples) and to be more at risk than Orientals but less at risk than Negroes. Countries with large black populations should be more at risk than those with smaller black populations (e.g. Brazil > Argentina). To reiterate, these predictions follow from the view that epigenetic rules incline *r*-strategy individuals to those co-factors placing them at risk, including not only multiple sexual partners and concomitant risk of other STDs, but also to drug abuse, criminality, poor education, and generally poorer health and social organization.

Recent support for our predictions of race differences in heterosexual transmission rates is available from both Europe and the United States. For 28 European countries reporting to the WHO Collaborating Centre in Paris as of 30 September 1987, we calculated that of the 524 cases known to be transmitted heterosexually (5% of total), 40% were from a person of African or Caribbean origin. For data from the U.S. reported to the Centers for Disease Control as of 14 November 1988, we calculated that of 3359 cases transmitted heterosexually (4% of total), 65% were black.

As many editorials from medical authorities make clear, the single most important recommendation to be given to avoid AIDS is to choose one's sexual partners with great care; ideally limiting oneself to a monogamous relationship with a person from a low risk group after having him or her test negatively for AIDS [13, 83]. Even within high-risk groups, the data is consistent in showing that those who are most sexually active are the ones most at risk. For example, one study contrasted Africans with AIDS living in Rwanda and Belgium with those without AIDS, matched for age, income, ethnic and geographic origin, finding the former were more likely to frequent prostitutes (81% vs 34%,  $P < 0.001$ ) and have a greater number of regular partners a year (means = 32 vs 3,  $P < 0.001$ ) than the latter [71]. Frequent contact with prostitutes, along with a history of sexually transmitted diseases, has been confirmed in studies of other African populations [84].

Some might find disagreeable our approach to race differences in the sensitive area of sexual behavior and AIDS, and particularly to our linking them to



genetically based evolutionary processes. It may be useful to remember that even if genetic predispositions are operating this does not deny the importance of environmental influences. Distal genetic effects are necessarily mediated by proximate neuroendocrine and psychosocial systems which have independent effects on phenotypic behavior, and provide potential mechanisms for intervention and alleviation of suffering.

In short, we have argued that members of some populations are more drawn than are members of other populations to those activities that put them at risk for AIDS. Calls are currently being made for healthy monogamous women who do not use intravenous drugs, along with people over the age of 65 to donate blood 3–4 times annually. Such donors are statistically unlikely to become afflicted with serum hepatitis, or retrovirus-associated immune deficiency syndromes unless they have themselves received transfusions of blood or blood products. Just as some populations are recognized as 'not-at-risk', recognizing that other populations may be at special risk may increase opportunities for prediction and prevention.

## REFERENCES

- Mann J. M. and Chin J. AIDS: a global perspective. *New Engl. J. Med.* **319**, 302–303, 1988.
- Barnes D. M. AIDS: statistics but few answers. *Science* **236**, 1423–1425, 1987.
- Curran J. W., Jaffe H. W., Hardy A. M., Morgan W. M., Selik R. M. and Dondero T. J. Epidemiology of HIV infection and AIDS in the United States. *Science* **239**, 610–616, 1988.
- Piot P., Plummer F. A., Mhalu F. S., Lamboray J-L., Chin J. and Mann J. M. Aids: an international perspective. *Science* **239**, 573–579, 1988.
- Mann J. M., Chin J., Piot P. and Quinn T. The international epidemiology of AIDS. *Scient. Am.* **258**, 82–89, 1988.
- Norman C. Politics and science clash on African AIDS. *Science* **230**, 1140–1142, 1985.
- Dickson D. Africa begins to face up to AIDS. *Science* **238**, 605–607, 1987.
- Quinn T. C., Mann J. M., Curran J. W. and Piot P. AIDS in Africa: an epidemiologic paradigm. *Science* **234**, 955–963, 1986.
- Swainbanks D. Japanese AIDS scandal over trials and marketing of coagulants. *Nature* **331**, 552, 1988.
- Bonneux L., van der Stuyft P., Taelman H., Cornet P., Goilav C., van den Groen G. and Piot P. Risk factors for infection with human immunodeficiency virus among European expatriates in Africa. *Br. med. J.* **297**, 581–583, 1988.
- Gordon A. M. HIV infection in Cuba (and reply). *J. Am. med. Ass.* **258**, 3387, 1988.
- Goedert J. J., Eyster M. E., Biggar R. J. and Blattner W. A. Heterosexual transmission of human immunodeficiency virus: association with severe depletion of T-helper lymphocytes in men with hemophilia. *AIDS Res. Human Retroviruses* **3**, 355–361, 1987.
- Masters W. H., Johnson V. E. and Kolodny R. C. *Crisis: Heterosexual Behavior in the Age of AIDS*. Little, Brown, New York, 1988.
- Heyward W. L. and Curran J. W. The epidemiology of AIDS in the U.S. *Scient. Am.* **258**, 72–81, 1988.
- Donegan S. P., Edelin K. C. and Craven D. E. HIV seroprevalence rate at the Boston City hospital. *New Engl. J. Med.* **319**, 653, 1988.
- Farthing C. F., Brown S. E., Staughton R. C. D., Cream J. J. and Muhlemann M. *A Colour Atlas of AIDS (Acquired Immunodeficiency Syndrome)*. Wolfe Medical Publications, London 1986.
- Newmark P. AIDS in an African context. *Nature* **324**, 611, 1986.
- Essex M. and Kanki P. J. The origins of the AIDS virus. *Scient. Am.* **258**, 64–71, 1988.
- Benn S., Rutledge R., Folks T., Gold J., Baker L., McCormick J., Feorino P., Piot P., Quinn T. and Martin M. Genomic heterogeneity of AIDS retroviral isolates from North America and Zaire. *Science* **230**, 949–951, 1985.
- Barin F., M'Boup S., Denis F., Kanki P., Allan J. S., Lee T. H. and Essex M. Serological evidence for virus related to simian T-lymphotropic retrovirus III in residents of West Africa. *Lancet* **1985-II**, 1387, 1985.
- Steel M. Fourth international AIDS conference: report. *Lancet* **1988-II**, 54–55, 1988.
- Rushton J. P. and Bogaert A. F. Race differences in sexual behavior: testing an evolutionary hypothesis. *J. Res. Person.* **21**, 529–551, 1987.
- Hofmann A. Contraception in adolescence: a review. 1. Psychological aspects. *Bull. Wld Hlth Org.* **63**, 151–162, 1984.
- Symons D. *The Evolution of Human Sexuality*. Oxford University Press, New York, 1979.
- Moore D. S. and Erickson P. I. Age, gender, and ethnic differences in sexual and contraceptive knowledge, attitudes, and behaviors. *Family Commun. Hlth* **8**, 38–51, 1985.
- Lewontin R. C., Rose S. and Kamin L. J. *Not In Our Genes*. Pantheon, New York, 1984.
- Weinrich J. D. Human sociobiology: pair bonding and resource predictability (effects of social class and race). *Behav. Ecol. Sociobiol.* **2**, 91–118, 1977.
- Rushton J. P. and Bogaert A. F. Race versus social class differences in sexual behavior: a follow-up test of the  $r/K$  dimension. *J. Res. Person.* **22**, 259–272, 1988.
- Weinberg M. S. and Williams C. J. Black sexuality: a test of two theories. *J. Sex Res.* **25**, 197–218, 1988.
- Rushton J. P. Differential  $K$  theory: the sociobiology of individual and group differences. *Person. Individ. Diff.* **6**, 441–452, 1985.
- Wilson E. O. *Sociobiology: The New Synthesis*. Harvard University Press, Cambridge, Mass., 1975.
- Johanson D. C. and Edey M. A. *Lucy: The Beginnings of Humankind*. Simon & Schuster, New York 1981.
- Eisenberg J. F. *The Mammalian Radiations: An Analysis of Trends in Evolution, Adaptation, and Behavior*. University of Chicago Press, Chicago, Ill., 1981.
- Pianka E. R. On  $r$ - and  $K$ -selection. *Am. Natural.* **104**, 592–597, 1970.
- Lovejoy C. O. The origin of man. *Science* **211**, 341–350, 1981.
- Ellis L. Criminal behavior and  $r/K$  selection: an extension of gene-based evolutionary theory. *Person. Individ. Diff.* **9**, 697–708, 1988.
- Rushton J. P. Differential  $K$  theory and race differences in E and N. *Person. Individ. Diff.* **6**, 769–770, 1985.
- Rushton J. P. An evolutionary theory of health longevity, and personality: sociobiology and  $r/K$  reproductive strategies. *Psychol. Rep.* **60**, 539–549, 1987.
- Rushton J. P. Toward a theory of human multiple birthing: sociobiology and  $r/K$  reproductive strategies. *Acta genet. Med. gemellol.* **36**, 289–296, 1987.
- Rushton J. P. Race differences in behaviour: a review and evolutionary analysis. *Person. Individ. Diff.* **9**, 1009–1024, 1988.

41. Rushton J. P. The reality of racial differences: a rejoinder with new evidence. *Person. Individ. Diff.* **9**, 1035-1040, 1988.
42. Bulmer M. G. *The Biology of Twinning in Man*. Clarendon Press, Oxford, 1970.
43. Westoff C. F., Calot G. and Foster A. D. Teenage fertility in developed nations: 1971-1980. *Family Plann. Perspect.* **15**, 105-110, 1983.
44. Ford C. S. and Beach F. A. *Patterns of Sexual Behavior*. Harper & Row, New York, 1951.
45. Vernon P. E. *The Abilities and Achievements of Orientals in North America*. Academic Press, New York, 1982.
46. Iwawaki S. and Eysenck H. J. Sexual attitudes among British and Japanese Students. *J. Psychol.* **98**, 289-298, 1978.
47. Lumsden C. J. and Wilson E. O. *Genes, Mind and Culture: The Coevolutionary Process*. Harvard University Press, Cambridge, Mass., 1981.
48. Rushton J. P., Littlefield C. H. and Lumsden C. J. Gene-culture coevolution of complex social behavior: Human altruism and mate choice. *Proc. Natn. Acad. Sci. U.S.A.* **83**, 7340-7343, 1986.
49. Freedman D. G. *Human Sociobiology*. Free Press, New York, 1979.
50. Plomin R., Loehlin J. C. and DeFries J. C. Genetic and environmental components of "environmental" influences. *Devl Psychol.* **21**, 391-402, 1985.
51. Money J. Food, fitness and vital fluids: sexual pleasure from Graham Crackers to Kellogg's Cornflakes. *Br. J. Sex. Med.* **11**, 127-130, 1984.
52. Money J. *The Destroying Angel*. Prometheus, New York, 1986.
53. Money J. and Anecillo C. Body image pathology: Koro, the shrinking penis syndrome in transcultural sexuality. *Sex. Marital Ther.* **2**, 91-100, 1987.
54. Lieh-Mak F. and Ng M. L. Ejaculatory incompetence in Chinese men. *Am. J. Psychiat.* **138**, 685-686, 1981.
55. Cole M. Sex therapy—A critical appraisal. *J. Psychiat.* **147**, 337-351, 1985.
56. Wilson J. Q., and Herrnstein R. J. *Crime and Human Nature*. Simon & Schuster, New York, 1985.
57. Davis G. E. and Leitenberg H. Adolescent sex offenders. *Psychol. Bull.* **101**, 417-427, 1987.
58. Kirk S. A. The sex offenses of blacks and whites. *Archs Sex. Behav.* **4**, 295-302, 1975.
59. Peters J. J. Children who are victims of sexual assault and the psychology of offenders. *Am. J. Psychother.* **30**, 398-421, 1976.
60. World Health Organization Technical Report. Treponemal infections: Report of a WHO Scientific Group. Series No. 674. WHO, Geneva, 1982.
61. Cates W., Farley T. M. M. and Rowe P. J. Worldwide patterns of infertility: is Africa different? *Lancet* **1985-II**, 596-598, 1985.
62. Shulman A. G. Absence of venereal disease in the People's Republic of China. *West. J. Med.* **130**, 469-471, 1979.
63. Brown S. T., Zacrias F. R. K. and Aral S. O. STD control in less developed countries: the time is now. *Int. J. Epidem.* **14**, 505-509, 1985.
64. Hasegawa T., Izumi S., Kurihara S., Ishizuka Y., Ho Y., Takechi A. and Tsuchiya M. Incidence of herpes infection of the uterine cervix observed in cytologic specimens in the Tokyo Metropolitan Area. *Acta cytol.* **29**, 363-366, 1985.
65. Osoba A. O. Sexually transmitted diseases in tropical Africa: a review of the present situation. *Br. J. Ven. Dis.* **57**, 89-94, 1981.
66. Fichtner R. R., Aral S. O., Blount J. H., Zaidi A. A., Reynolds G. H. and Darrow W. W. Syphilis in the United States: 1967-1979. *Sexually Transmitted Dis.* **10**, 77-80, 1983.
67. Mascola L., Pelosi R., Blount J. H., Binkin N. J., Alexander C. E. and Cates W. Congenital syphilis: why is it still occurring? *J. Am. med. Ass.* **252**, 1719-1722, 1984.
68. Potterat J. J., Rothenberg R. B., Woodhouse D. E., Muth J. B., Pratts C. I. and Fogle J. S. II Gonorrhoea as a social disease. *Sexually Transmitted Dis.* **12**, 25-32, 1985.
69. Alter M. J., Ahtone J., Weisfuse L., Starko K., Vacalis D. and Maynard J. E. Hepatitis B virus transmission between heterosexuals. *J. Am. med. Ass.* **256**, 1307-1310, 1986.
70. Brandt A. M. The syphilis epidemic and its relation to AIDS. *Science* **239**, 375-380, 1988.
71. Clumeck N., van de Perre P., Carael M., Rouvroy D. and Nzaramba D. Heterosexual promiscuity among African patients with AIDS. *New Engl. J. Med.* **313**, 182, 1985.
72. Westney O. E., Jenkins R. R., Butts J. D. and Williams I. Sexual development and behavior in black preadolescents. *Adolescence* **19**, 557-568, 1984.
73. Eveleth P. B. and Tanner J. M. *Worldwide Variation in Human Growth*. Cambridge University Press, 1976.
74. Asayama S. Adolescent sex development and adult sex behavior in Japan. *J. Sex Res.* **11**, 91-112, 1975; Booth W. AIDS and drug abuse: no quick fix. *Science* **239**, 717-719, 1988.
75. Jones E. A. Innovation and *r* and *K* selection. *J. Soc. Biol. Struct.* **11**, 101-105, 1988.
76. Garbarino J. and Ebata A. The significance of ethnic and cultural differences in child maltreatment. *J. Marriage Family* **45**, 773-783, 1983.
77. Kulin H. E. Adolescent pregnancy in Africa: a programmatic focus. *Soc. Sci. Med.* **26**, 727-735, 1988.
78. Zhangling W. Chinese family problems: research and trends. *J. Marriage Family* **45**, 943-948, 1983.
79. Johnson L. B. Sexual behavior of southern blacks. In *The Black Family: Essays and Studies* (Edited by Staples R.), 2nd edn. Wadsworth, Belmont, Calif., 1978.
80. Staples R. The black dating game. In *The Black Family: Essays and Studies* (Edited by Staples R.), 2nd edn. Wadsworth, Belmont, Calif., 1978.
81. Eysenck H. J. *Sex and Personality*. Open Books, London, 1976.
82. Martin N. G., Eaves L. J. and Eysenck H. J. Genetical, environmental and personality factors influencing the age of first sexual intercourse in twins. *J. biosoc. Sci.* **9**, 91-97, 1977.
83. Hearst N. and Hulley S. B. Preventing the heterosexual spread of AIDS. *J. Am. med. Ass.* **259**, 2428-2432, 1988.
84. Simonsen J. N., Cameron D. W., Gakinya M. N., Ndinya-Achola J. O., D'Costa L. J., Karasira P., Cheang M., Ronald A. R., Piot P. and Plummer F. A. Human immunodeficiency virus infection among men with sexually transmitted diseases: Experience from a center in Africa. *New Engl. J. Med.* **319**, 274-278, 1988.