RESEARCH AND PERSPECTIVES IN LONGEVITY
Sex and Longevity: Sexuality, Gender, Reproduction, Parenthood

With 36 Figures and 21 Tables
In most human societies, females live longer than males, though we do not understand why this is so. Another puzzle is why some people live in good health to great ages while others die relatively young. It is becoming increasingly urgent to find answers to these questions because improved diet, public health and medicine mean that many more people will live longer, leading to an ageing of the human population. An international group of experts, hosted by the Fondation IPSEN, met in Paris in October 1999 to discuss the latest advances towards understanding why some of us age faster than others, during the third meeting of the series “Colloques Médecine et Recherche”, which is devoted to “Research and Perspectives in Longevity”.

The studies that follow the lives of defined groups of people over many years are important sources of information on longevity. In the Netherlands, sex differentials in survival at ages 1, 15, 40 and 50 were examined through two longitudinal studies. Both studies suggest that women have a higher chance of survival at each age, which may in part account for more women than men surviving into old age (D.I.H. Deeg, Amsterdam, The Netherlands). Another source of reliable data is the records of aristocratic families (T. Kirkwood, Newcastle upon Tyne, UK; L. Gavrilov and N Gravrilova, Chicago, USA) in which a higher fertility, i.e., more children, seems to be related to a shorter life, indicating that the available resources are distributed between the maintenance of one's own body and reproduction (T. Kirkwood).

The tendency to live longer seems to run in families. Evidence that this longevity is, at least in part, inherited comes from the study of four American families that are remarkable for their number of survivors into very old age. For example, in one family, 5 of 16 siblings became centenarians, which is highly unlikely to be a chance event (T. Perls, Boston, USA). Examination of the population register for the Valserine Valley in the French Jura in the 18th and 19th centuries has shown the sex dependence of human longevity and of its inheritance: the pattern indicates that survival beyond reproductive age is linked to the sex-determining X chromosome (A. Cournil, Lyon, France). Support for this conclusion comes from a study of European royal and aristocratic families showing that daughters born to fathers over the age of 45 were more likely to die young than were sons, implicating an accumulation of deleterious mutations on the X chromosome during the parent's life (L. Gavrilov and N. Gravrilova, Chicago, USA).
Parenthood also influences survival. It makes sense in evolutionary terms that parents should survive until their offspring is independent. A comparison of parenting and survival across several species of apes and monkeys revealed that the sex that invests most in raising the offspring lives longer. The clearest example is the comparison between the New World spider monkey, where the females do most of the parenting and live much longer, and the owl and titi monkeys, where the males do most of the childcare and considerably outlive the females (J. Allman, Pasadena, USA). In humans the pattern is less striking, perhaps because males take part of the responsibility for raising children. Child-bearing itself affects longevity in human females: women having two to five children later in their reproductive span are likely to live longer (E. Lund, Tromso, Norway). However, mothers over the age of 35 do not seem to transmit their longevity to their offspring, whereas younger mothers do (L. Gavrilov and N. Gravrilova, Chicago, USA).

Why females should survive well after they lose fertility, a phenomenon that is not unique to humans but widespread among mammals, is hotly debated. It may be an advantage to have older females in the population with time and experience to invest in the care of their children's offspring. This "grandmother" effect has been demonstrated in demographic data from the Gambia (R. Mace, London, UK).

But menopause may have had other evolutionary roots, onto which grand-mothering has been grafted as a cultural development. Studies of lions and baboons indicate that the primary advantage may be to ensure that the mother survives until the last of her offspring becomes independent; the relatively early occurrence of menopause in humans may reflect the long period of infancy (C. Packer, St Paul, USA). Menopause thus seems likely to have positive functions, rather than being merely a byproduct of modern women living to greater ages. Such perspectives need to be considered seriously as techniques that artificially extend the human reproductive span are being developed. The controversial topic of countering the effects of ageing by supplementing the waning sex hormones in men as well as women is also discussed (J. Morley, St Louis, USA).

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