bladder preparations were similar in *R. sylvatica* and the closely related, but freeze-intolerant, common frog (*R. temporaria*) of Europe and the leopard frog (*R. pipiens*) of North America. We also noted bladder permeability to glucose in the taxonomically distant bufonid, *Bufo marinus*, and the neotenic urodele, *Necturus maculosus*.

The taxonomic diversity of species exhibiting glucose permeability of the bladder indicates that this organ is fundamental for energy balance in amphibians whose carnivorous diet contains little carbohydrate[10]. The urinary bladder has long been used in studies of solute and water permeability, and may prove to be an ideal model for investigating transepithelial glucose flux.

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Parental age gap skews child sex ratio

The proportion of male to female births increases during and shortly after periods of war[1,2]. We show that the age difference between parents (age of husband − age of wife) predicts the sex of the first child. We also find that in England and Wales, the mean spouse age difference increased during and immediately after the two World Wars and was strongly correlated with the sex ratio during the period 1911–52.

We obtained the age and sex of children from 301 families who attended secondary schools that recruited from a wide range of socioeconomic groups. The mean age difference D_a (age of husband − age of wife) was 2.48 years ± 0.23 (s.e.m.) and there were 301 first-born and 260 second-born children. Among first-borns there was an excess of daughters from couples with low D_a and an excess of sons from those with high D_a ($D_a = -9$ to -1 years: 14 sons and 29 daughters; $D_a = 0$ to 5 years: 117 sons and 84 daughters; $D_a = 5$ to 15 years: 37 sons and 20 daughters; $\chi^2 = 11.86$, $P = 0.0027$). Among second-borns there was the opposite but non-significant tendency ($D_a = -9$ to -1 years: 22 sons and 11 daughters; $D_a = 0$ to 4 years: 93 sons and 89 daughters; $D_a = 5$ to 17 years: 20 sons and 25 daughters; $\chi^2 = 3.93$, $P = 0.14$).

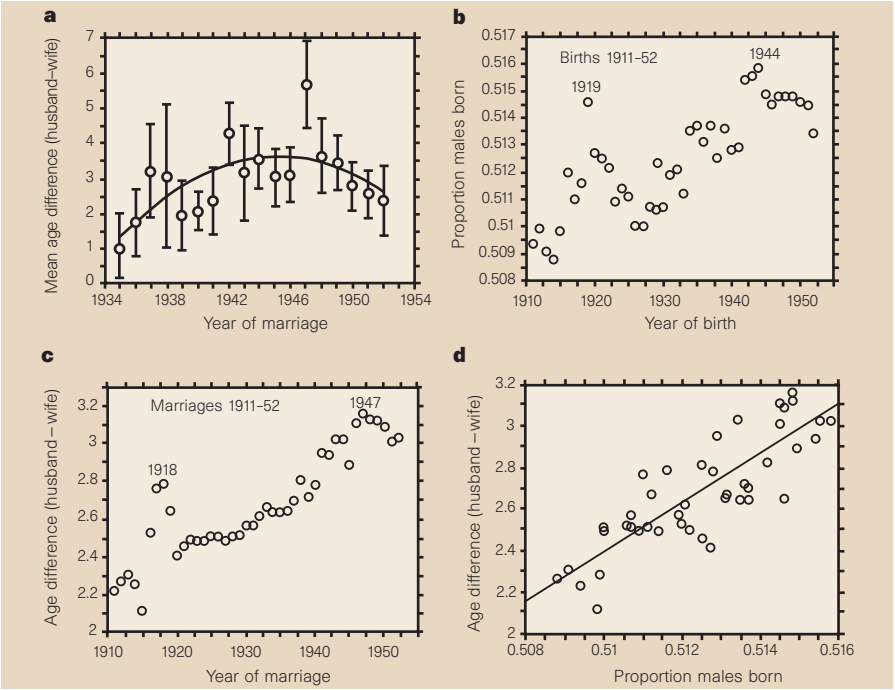

Figure 1 Parental age differences and sex-ratio statistics, 1911–52. **a,** The relationship between the mean (± s.e.m) of the difference in age between husbands and wives (D_a) and year of marriage (1935–52) in the Woolton area of Liverpool. There is a significant curvilinear relationship with a peak value of D_a in 1947 (second order polynomial, $y = -42.15 + 2.024x - 0.022x^2$, $F = 5.88$, $P = 0.013$, $n = 469$ marriages). **b,** Sex ratios of births registered in England and Wales from 1911–52; and **c,** D_a for marriages in the same period. **d,** Linear regression of sex ratio of births in England and Wales against D_a, 1911–52 ($r^2 = 0.68$, $F = 86.46$, $P = 0.0001$).

The age of parents at the birth of the child has a weak effect on the child's sex[3]. However, multiple regression analyses with sex of child as the dependent variable and D_a and age of mother or father at birth as independent variables showed that D_a remained significantly associated with sex of child (D_a/age of mother — D_a: standardized partial regression coefficient $b_1 = -0.14$, $t = 2.35$, $P = 0.02$; age of mother: $b_2 = 0.13$, $t = 0.22$, $P = 0.83$; D_a/age of father — D_a: $b_1 = 0.14$, $t = 2.34$, $P = 0.02$; age of father: $b_2 = 0.13$, $t = 0.21$, $P = 0.83$).

Local and national patterns of D_a during the period 1911–52 (ref. 4) are shown in Fig. 1a, c. If couples do not delay the birth of their first child, D_a and sex ratio should be correlated and changes in the sex ratio should be preceded by changes in D_a. This is seen in 1914–18 but not during the Second World War (Fig. 1b, c). Registration of second and subsequent births will weaken the relationship between D_a and sex ratio so that an exact correlation is unlikely. Nevertheless a regression of sex ratio on D_a shows that the latter explains 68% of the variance of the former (Fig. 1d). Age of woman at marriage was negatively related to the sex ratio ($b = -0.003$, $r^2 = 0.23$, $F = 12.19$, $P = 0.001$). However a multiple regression analysis with sex ratio as the dependent variable and D_a and bride's age as independent variables left D_a as the only significant correlate of sex ratio (D_a: $b_1 = 0.78$, $t = 8.26$, $P = 0.0001$; age of bride: $b_2 = -0.14$, $t = 1.51$, $P = 0.14$).

Rank in many animals is related to the sex of their offspring[5]. In humans, the elite often form partnerships with high D_a[6] and have more sons than daughters[7]. It may be that during wartime women prefer to marry older men with high resources and this leads to an increase in D_a. We do not know how the sex of first-borns is adjusted in relation to D_a. Women could influence the motility of sperm bearing either X or Y chromosomes or they may invest differentially in males and females *in utero* leading to higher miscarriage rates of one or the other sex.

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