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## **Menopause with a cause: The evolution of monogamy in response to female fertility loss**

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The human species is unique in its tendency towards monogamy, a trait which can be traced back to hunter-gathering societies. Traditional explanations for this evolution have focused on the presence of paternal care and the needs of our offspring. However, recent research has challenged this claim, contending that the significant effects of mating competition on male choice result in evolutionary equilibria with little male care. This paper models the population dynamics of a rudimentary hunter-gathering society, and determines sufficient conditions for monogamy to supersede pure mating strategies as the optimal allocation of male reproductive effort. Utilising an approach based on the graphical analysis of systems of nonlinear ordinary differential equations, various situations were considered including the variation of reproduction rate, sex ratio and fertility loss. While our results concur with previous findings that male pair bonding triumphs in response to partner scarcity and male-biased populations, a dynamic expected gain model extended this reasoning to explicitly show that menopause and the age of menopause occurrence directly cause the evolutionary bias sufficient to cause a shift away from the multiple mating strategy.

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