Evolution of genomic imprinting in mammals as genomic conflict

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Some mammalian genes show genomic imprinting, in which the paternally and maternally derived alleles are expressed differently. The genetic conflict hypothesis states that the paternal allele has evolved to be more aggressive than the maternal allele in obtaining maternal resources because of the lower relatedness to the sibs of the same mother. I first explain a quantitative genetic model for cis-regulating element of an embryonic gene affecting maternal resource acquisition. The model supports the verbal argument -- a growth enhance gene evolves imprinting with paternal allele expressed and maternal allele inactive, whilst a growth suppressor gene evolves the pattern with paternal allele inactive and maternal allele active. Second, I discuss major problems of the conflict hypothesis: Some genes affect embryonic growth but are not imprinted (e.g. Igf1); Paternal disomies are sometimes smaller than the normal embryo; and X-linked genes do not follow the predictions but codes for sexual differentiation. These can be explained by modified versions of the basic model. Finally, some imprinted genes controls the maternal behavior of adults females, rather than the resource acquisition from their mother. I show that paternal expression of care enhancing gene should evolve if related females form a breeding unit in which they compete for their breeding success. However if the competing reproductive females mate with a single common harem male, the imprinting toward the opposite direction (maternally expressed) should evolve, indicating the importance of the mating system.