

Genomic Imprinting

Imprinted genes

- genes whose expression is determined by the parent that contributed them (maternal or paternal).
- violate the usual rule of inheritance that both alleles in a heterozygote are equally expressed.

Another way to think of genomic imprinting is as "parent of origin differences" in the expression of inherited traits.

*Genetic imprinting thus appears to be a form of regulation of the expression of inherited genetic information.

Mechanism: The process of imprinting starts in the gametes where the allele destined to be inactive in the new embryo (either the father's or the mother's as the case may be) is "marked". The mark appears to be **methylation** of the DNA in the promoter(s) of the gene.

Evidence: (for the existence of genetic imprinting) has also come from both animal and human studies: Mice developed by transgenic experiments so that they have only either maternally derived or paternally derived genes are phenotypically different.

- Those with only paternally derived genes have relatively normal development of membranes and placentas, but very poor development of embryonic structures.
- Those with only maternally derived genes have relatively good embryonic development but poor membranes and placentas.

**Both types of mice are non-viable.

Two Examples:

1. *IGF2*

— the gene encoding the **insulin-like growth factor-2**

In humans (and other mammals like mice and pigs) the *IGF2* allele inherited from the father (paternal) is expressed; the allele inherited from the mother is not!!

If both alleles should begin to be expressed in a cell, that cell may develop into a cancer.

2. *IGF2r*

— the gene encoding the cell **receptor for Igf-2**

In mice the *IGF2r* allele inherited from the mother is expressed; that from the father is not.

