Genomic Imprinting

- Mammalian cells are diploid, containing one set of genes inherited from the father and one set from the mother.

- In a few cases the expression of a gene has been found to depend on whether it is inherited from the mother or the father, a phenomenon called genomic imprinting.

24 SUNDAY

- Genomic imprinting is a relatively uncommon feature of mammalian genomes in which only one of a pair of genes, present on homologous chromosomes in a diploid nucleus, is expressed, the second being silenced by methylation. (Feil and Khosla, 1999).

MONDAY 25

It is always the same member of a pair of genes that is imprinted and hence inactive; for some genes this is the version inherited from the mother, and for other genes it is paternal version.

[Methylation

In eukaryotes, Cytosine bases in chromosomal DNA molecules are sometimes changed to 5-methylcytosine by addition of methyl group by enzyme DNA methyl transferases. Methylation results in repression of gene activity (Jones, 1999)]

TUESDAY 26

- thirty genes in humans and mice are found to display imprinting.

An example, is Igf-2 gene, which codes for a growth factor, protein involved in signaling between cells (Box 25.2)

[AMH - is a 560-amino acid glycoprotein secreted from the Sertoli cells. This hormone is believed to bind to the mesenchyme cells ~~secreted from~~ surrounding Mullerian ducts and to cause these cells to secrete a

27 WEDNESDAY

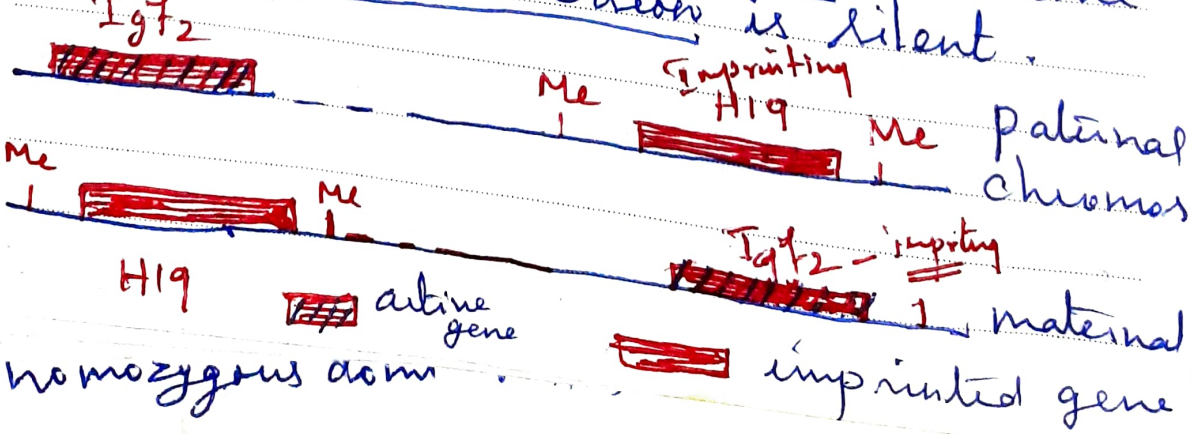
Paracrine factor that induces apoptosis (= cell death) in the Mulleri-an duct epithelium (Robert et al., 1999

When protein synthesized by one cell can diffuse over small distances to induce changes in neighboring cells, the event is called a paracrine interaction

On the chromosome inherited from the mother various segments of DNA in the region of Igf2 gene

28 THURSDAY

are methylated, preventing the expression of this copy of the gene. The second imprinted gene, H19, is located about 95 kb away from Igf2 gene, but the imprinting is the other way round the maternal version of H19 is active and the paternal version is silent.



31 SUNDAY

This fig. shows a pair of imprinted gene on human chromosome 11, Igf2 gene is imprinted on the chromosome inherited from the mother, and H19 gene is imprinted on the paternal chromosome. The two genes are approximately 95 kb apart (after Brown, 2002).

The function of imprinting is not known. One possibility is that it has a role in development because artificially created parthenogenetic mice which have two copies of the meternal genome, fail to develop properly.

The gene for insulin-like growth factor-2 (Igf2) is one example of an imprinted gene. Igf2 gene is required for prenatal growth and mice that do not express Igf2 are born half the size of normal mice. Only the paternal copy of Igf2 is transcribed. As a result, mice with a mutated paternally derived Igf2 gene are stunted, while mice with a defective maternally derived Igf2 gene are normal.

APRIL 2013

17 18 19 20 21 22 23 24 25 26 27 28 29 30
WED THU FRI SAT SUN MON TUE WED THU FRI SAT SUN MON TUE

TUESDAY 9

Sex linked Inheritance
Codominance

Incomplete dominance.

The situation in which traits are determined by both alleles of a hybrid are fully expressed, there is no masking effect or dilution of phenotype compared to the homozygotes for each allele.

Co-dominance:

In co-dominance both the dominant and recessive characters occur side by side in F_1 hybrids to give a mixed colour.

Best example of co-dominance has been observed in cattle, when a cattle of red coat is crossed with the cattle of white coat,

the F_1-heterozygote or hybrid is found to possess roan coat.

In roan coat the red and white hairs occur in definite patches but no hair has intermediate colour of red and white.

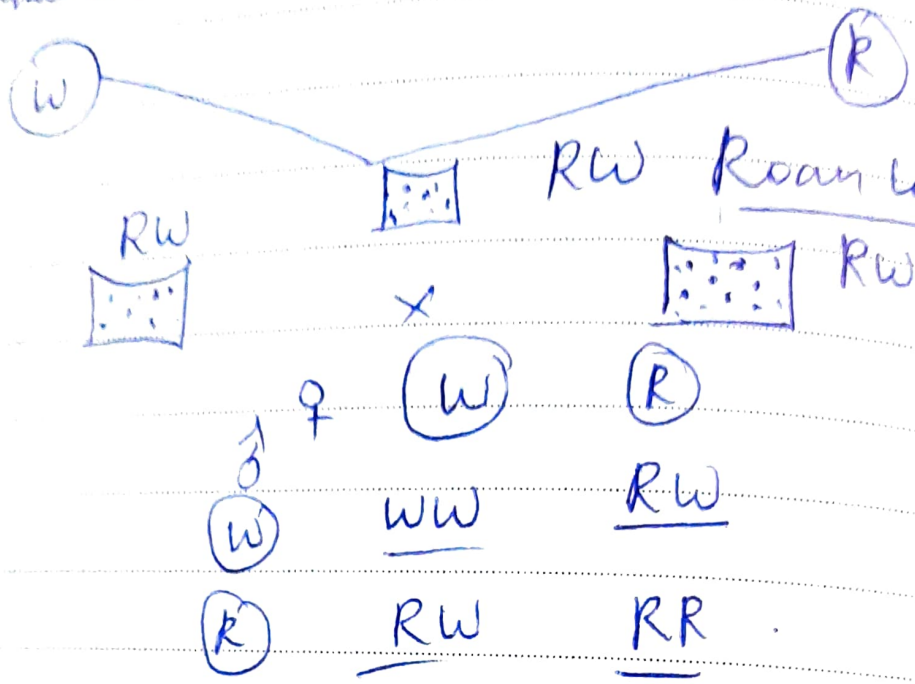
WEDNESDAY 10

11 THURSDAY

WW
White coat

× RR
pure red coat

F1



Inheritance of co-dominance of red-white coat colour in cattle

12 FRIDAY

Incomplete dominance:-

The law of dominance does not occur universally. In some plants e.g., red and white flowered pea plant, Snap dragon and also in some animals such as Andalusian fowl with black and white feathers and also the red and white coat of cattle

homozygous ww.

such incomplete dominance are found.

SATURDAY 13

Red - white flowered pea plant:

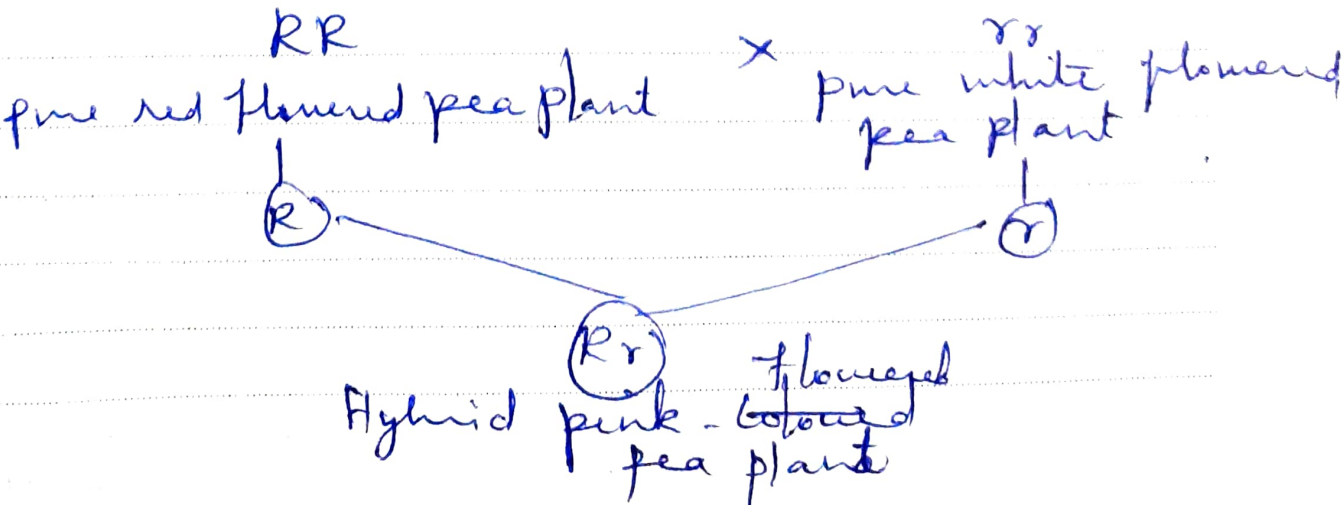
When a red flowered pea plant (RR) is crossed with white flowered pea plant (rr) the F1 hybrid pea plants are found to have pink flowers.

It shows that gene for red colour could not dominate the gene for white colour.

The appearance of this intermediate character in F1 generation is known as incomplete dominance.

SUNDAY 14

Again, when these F1 hybrids are inbred, the red, pink and white coloured flower plants are produced in 1:2:1 ratio.



15 MONDAY

P_2 (inbreeding) Rr pink flowered plant × Rr Pink flowered plant

F_2 RR pure Red flowered pea plant, Rr Hybrid pink flowered pea plant, Rr ", rr Pure white flowered pea plant

Black and white feathered Andalusian Fowl (long boy, 2 horns).

16 TUESDAY

when a homozygous Andalusian fowl with black feathers with homozygous fowl with splashed white feathers, the F_1 hybrids are found to contain blue feathers.

when these hybrids are inbred again black, blue and white feathered birds are produced in 1:2:1 ratio.

P_1 – BB (Black) × bb (white)

F_1 – (B) (b)

P_2 Bb hybrid blue feather × Bb hybrid blue feather.

homozygo...

WEDNESDAY 17

F_2

♂ \ ♀	B	b
B	BB pure Black	Bb Hybrid Blue
b	Bb Hybrid Blue	bb pure white further

1 : 2 : 1

THURSDAY 18