2013 X Inactivation in Mammals ~~Chromosome~~ MAY

MAY 2013

17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
FRI SAT SUN MON TUE WED THU FRI SAT SUN MON TUE WED THU FRI

FRIDAY 31

Sex chromosomes in Resting nuclei : Barr bodies and Lyon's hypothesis

- In 1949 Murray L. Barr and E.G. Bertram found that the nerve cells of the female cat had a small, dark staining body against the nuclear membrane.

- This body was absent in the neurons of male cats.

- It was subsequently found in many tissues and organs not only in female cats but of a large no. of mammalian females including human beings.

- It was always absent in males

- The name Barr body (after the discoverer) or sex chromatin (due to its association with sex) was given to it.

In human beings it is easily observed in scrapings from the mouth & cavity.

MONDAY 3

In 1969 Mary F. Lyon proposed that in normal female one of the 2 X Chromosomes was inactive and Condensed as a deeply staining body. It takes up more DNA stain

The second X chromosome was active and extended and therefore not be stained in interphase nuclei.

Males have a X chromosome which is active and uncondensed.

TUESDAY 4

In abnormal individuals with multiple X chromosomes, one X chro is active, all the remaining X chromosomes are Condensed into a Corresponding no. of Sex chromatin bodies. This is known as Lyon's hypothesis and It is has been verified in a no. of mammalian species.

Autoradiographic technique

The inactive X have been revealed by the autoradiographic technique. It has been found that the condensed X of mammalian females is late replicating so that during the S ph

5 WEDNESDAY of DNA synthesis it lags behind the active 'X' chromosome.

The late replication is associated with the condensed state and inactivation or switching off of genes.

The question arises as to which of the 2 x chromosomes is late replication and forms the Barr body? out of 2 x chromo one x chro derived from the paternal parent, the other from the maternal parent.

It has been found that in some tissues
6 THURSDAY the late replicating x may be the one derived paternally, while in other tissues of the same individual the maternal x would be late replicating this phenomenon affect the functioning of the sex linked genes borne on the 2 chromosomes.

Mammalian females are therefore genetic mosaics for some of their sex linked genes. eg. The tortoise-shell cat with

9 SUNDAY

Eg: 3

Another proof that the condensed x-chromosome has mostly inactive non-functional genes came from studies of the enzyme G-6-PD by Davidson and his Colleagues. 'glucose-6-phosphate dehydrogenase'

① . The enzyme G-6-PD is Controlled by genes on the x chromosome.

② . The enzyme has 2 variants ① . normal and ② . deficient.

10 MONDAY

③ . The enzymatic activity in blood of both the sex is normal.

④ . A heterozygous women had 2 variants of enzyme . but

① . a cell is cultured to form identical daughter cells of a clone :

② . each clone contains either one enzyme ~~variant~~ normal or deficient but not both.

This indicates inactivation of one x chromosome in a clone.

MON TUE WED THU FRI SAT SUN MON TUE WED THU FRI SAT SUN

Example ①.

FRIDAY 7

Tortoise-shell cats (mixture of black & white patches)

↓

The cat formed from a cross between black & a white skinned cats

↓

offsprings shows black patches & white patches in F1 generation where the X chrom from the black parent is active and where the 2nd X is active. Hence the tortoiseshell appearance.

Eg ②. a similar effect is noticed in Variegated Coat Colour in mice

SATURDAY 8

Lyon's hypothesis can also be demonstrated by autoradiography of cells of the female mule (between horse & donkey). Where the X-chro from the donkey parent differs morphologically and is easily identified from the horse X. It can be observed that in some cells the donkey X is late replicating, in other cells the horse X is late replicating.

1 SATURDAY The method is of great value in determining the sex of new born babies.

— Sex chromatin is also present in the polymorphonuclear leucocytes of circulation blood in females in the form of a small body called drumstick attached to one of the lobes of the nucleus. Barr bodies

— Barr bodies are not present in Drosophila.

2 SUNDAY — Barr bodies number is always one less than the no. of chromosomes in the cell.

XX — ① Bb
XO — 0
XXX — 2 Bb
XXXX — 3 Bb
XXXXX — 4 Bb.

abnormal