Red cell Antigens

It presents on the surface of RBCs in animal resemble ABO system in human. It formed from 4 sugars attached to protein backbone.

Gene	Enzyme coded	Sugar added to basic form
Gene I^A in group A	N-acetyl galactosaminyl transferase	N-acetyl galactosamine transferase
Gene I^B in group B	Galactosyl transferase	galactose
Gene I^A & I^B in group AB	Co dominant produce both enzyme	Both sugars
Gene ii in group O	No enzyme	No sugar

Technique for detection:

Inject blood of donor (Ag A) into recipient blood, it will form Ab against Ag A accumulate in its serum (Antisera A). Collect antisera A to use for testing if agglutinate +ve result for Ag A. By the same procedure collect other antisera.

N.B:

- There are 60 blood group in domestic animals, controlled by multiple allele (B system in cattle contain 600 allele.
- B system in cattle & sheep has same Ag, C system in sheep & goat has same Ag.
- Ab in ABO system in human, J system in cattle & AB system in cat are present naturally while in other system it produced after challenge with Ag.

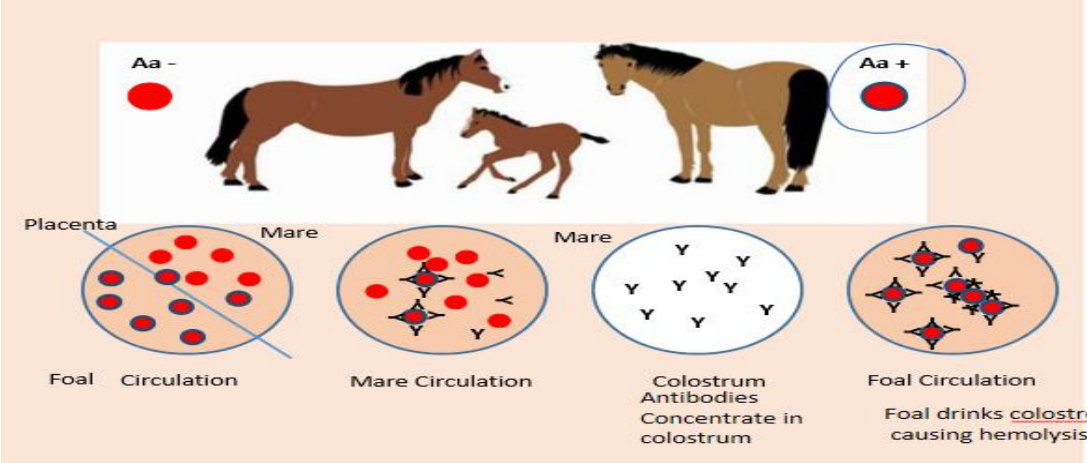
Neonatal Isoerythrolysis (NI)

Its disease of newborn in horse, dog, cattle & pig. Its due to dam is –ve for Ag & fetus is +ve for such Ag.

Mechanism of occurrence:

Dam have –ve Ag (Ag-) & fetus have +ve Ag (Ag+) from sire.occur feto-maternal hemorrhage during pregnancy or birth release blood from fetus

to dam circulation. Dam produces Ab in her serum against fetus Ag+. Ab pass to dams milk then to fetus which absorb it into blood stream it destroy all RBCs contain Ag+ & cause death within hours.



N.B:

- NI is more severe in 2nd birth.
- NI differ from erythroblastosis fetalis in human (involve Rh system) as Ab pass through placenta before birth causing severe anemia & death of fetus.

Prevention:

- Using of foster mother or bottle fed may save life.

The Major Histocompatibility Complex (MHC)

It is well known that organ and tissue transplantation and skin grafting is often followed by rejection by the recipient's body.

Obviously, there is a genetic basis to transplanted rejection. Transplant rejection is controlled by natural cell surface antigen called histocompatibility antigens. The inheritance of these antigens is similar to red blood group antigens, autosomal and codominant.

Although many loci (more than 30 in mice) produce antigens that play a role in transplant rejection, there is limited group of loci that play a much more important role than the others.

They constitute the major histocompatibility complex. Each locus within the complex may have up to 100 multiple alleles.

MHC classes

Class I antigens: called SD (serologically defined), occur on almost all nucleated cells of the body.

Class II antigens: called LD (lymphocyte defined). They have restricted distribution, mainly on B-lymphocytes ad macrophage.

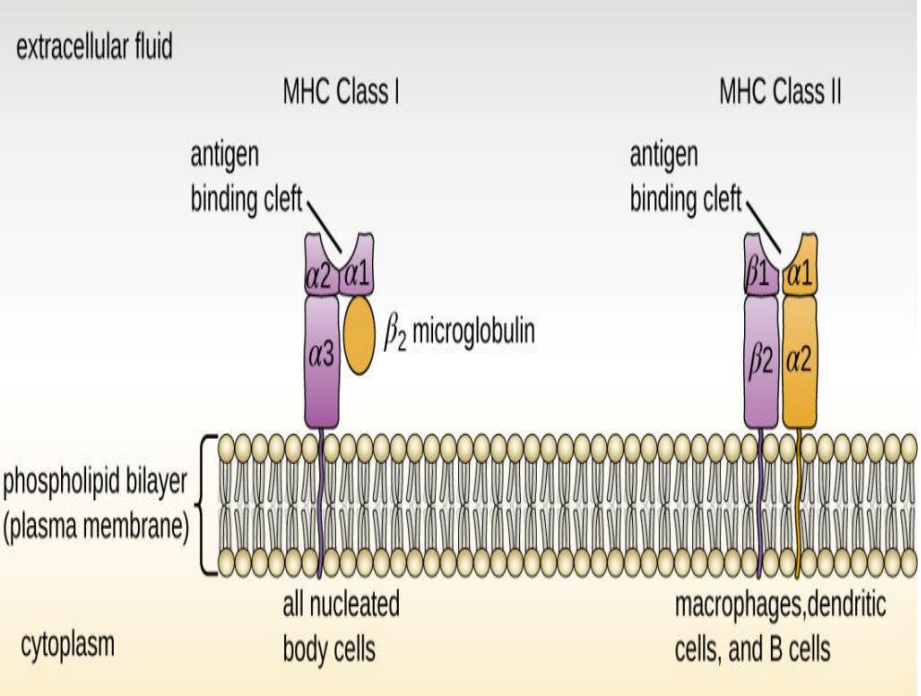
Structure of MHC Antigens

Class I antigen:

consists of two polypeptide chains. The larger chain passes the cell membrane, and is the product of a MHC locus. The smaller chain of class I antigen is not attached to the cell membrane, and is the product of a locus that is separated from MHC region.

Class II antigen:

Two relatively small chains which are similar in size and both path through the cell membrane. The smaller one carry the antigenic specificity, but both chains are believed to be the product of segments of DNA within the D locus.



Complement

Complement is the name given to a group of serum proteins which plays an important role in the body's defenses.

It is involved in the enzymatic activities leading to fracture of cell wall and cell death after the formation of antigen-antibody complex on the surface of a foreign cell.

Although complement has various roles which have not yet been well studied, yet the genetic basis

of some of the components of complement is well understood.

In particular, loci coding for several of these components are located within the MHC region. This signifies that the MHC is generally involved in the genetic control of the body's defenses.

GENETIC RESISTANCE AND PATHOGENS

Pathogens including parasites, bacteria, virus, etc exert a profound influence on animal production throughout the world. The genetic aspects involved in this subject have been the subject of active research. Studies have been made in genetic control of

1. Host pathogen interaction.
2. Resistance of the host against the pathogen and resistance of the pathogen itself to drugs such as insecticides, anthelmintics and antibiotics. The first two of these aspects will be considered

Genetic Control of Infectious Diseases

The presence of genetic variation for resistance to parasites and pathogens can be exploited by means of artificial selection for resistance to infectious disease.

Resistance in this case does not have to measured by the actual challenge by the infective agent. However, the measurement of the immune response to vaccination, as an indication of animal's resistance, could be of practical value.

Genetic Control of Inherited Diseases

Inherited diseases controlled by a single gene locus are easier to control if the affected individual or the heterozygote can be culled.

Heterozygote detection by

1. Pedigreed herds, or by the use of test crossing.
2. Biochemical screening: In the case of inborn errors of metabolism

3. DNA screening. This method depends on the presence of DNA polymorphism, caused by difference in nucleotide sequence between the mutant gene and the normal one.

a. Gene Therapy

1. Somatic gene therapy:

This is a very recent method in which normal gene can be inserted into the genome of the same affected individual. The steps involved are:

1. Identify and isolate the normal gene at the relevant locus or construct it if its amino acid sequence is known.

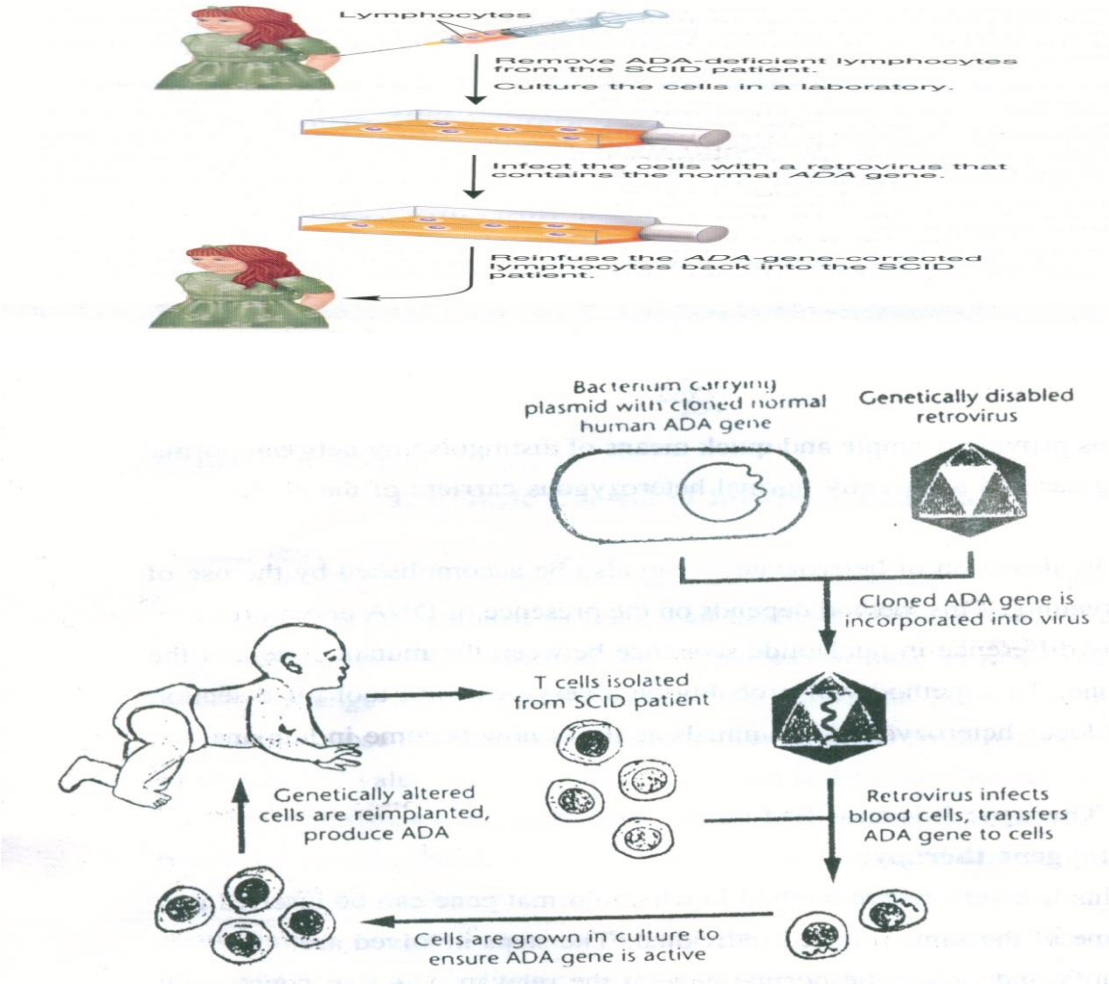
2. Produce large number of copies of the gene by cloning

3-Insert the foreign DNA into appropriate cells previously removed from the patient.

4- Replace the "repaired" cells in the patient.

In addition to treating heritable genetic disorders, gene therapy is now being used or contemplated as

a treatment for skin cancer, breast cancer, brain cancer and AIDS.



2. Germ-line gene therapy:

The most promising approach in gene therapy involves adding the relevant foreign DNA to a fertilized ovum or to an embryo at the blastocyst stage.

In the former case, the DNA is injected into one of the pronuclei of the fertilized egg, before the two pronuclei fuse.

Gene therapy applied to fertilized eggs or to embryos involves inserting foreign DNA into all or most of the cells, including the germ cells of the resultant individuals who then pass on their own genes and the added foreign genes to future generation.

b. Enzyme Replacement Therapy:

Involves supplying the affected individual with regular doses of the deficient enzyme or with normal cell or tissue transplants.

One of the major disadvantages of the second approach is the problem of foreign tissue rejection. Gene therapy could overcome this problem, as the cells of the affected individual itself are removed and returned to its body after being "repaired".3