NAME: Ehie Great Chimsom

MATRIC NO: 17/SCI03/003

DEPARTMENT:BIOCHEMISTRY

COURSE CODE:BCH 314

**GENETIC BASIS OF ANTIBODY DIVERSITY**

Chickens generate antibody diversity in a manner that is quite unlike that seen in mammals. Chickens have only one functional V gene and one J gene for both light chains and heavy chains, although they do have 16 different D genes. Chicken immunoglobulin diversity is, therefore, generated by inserting gene sequences from nonfunctional pseudogenes in a process called gene conversion. Although they have only one functional V gene, chickens have a large number of V pseudogenes that serve as sequence donors. During recombination of the V and J genes, single bases are also added to each gene (N-region addition), and joining occurs at random. Chicken immunoglobulins are further diversified by somatic hypermutation and imprecise V–J joining. A second major difference involves the timing of this process. In mammals, rearrangement of immunoglobulin genes occurs throughout life. In chickens, however, immunoglobulin genes are rearranged as a single wave between 10 and 15 days of embryogenesis, when there is clonal expansion of B cells in the [bursa of Fabricius](https://www.sciencedirect.com/topics/veterinary-science-and-veterinary-medicine/bursa-of-fabricius). During that 5-day period, birds generate all the antibody specificities they will need for the rest of their lives. After the bursa degenerates at puberty, the chicken must largely make do with the B cell diversity generated in early life. However, once a mature chicken B cell is stimulated by exposure to an antigen, it can generate additional V-region diversity by further gene conversion. The chicken can generate about 106 different immunoglobulin molecules. This is approximately one order of magnitude less than in the mouse.

The generation of antibody diversity in birds differs significantly from that in the species described previously and in mammals. The best-studied bird with respect to Ig gene structure is the chicken (refer to Fig. 21-4). The Igh locus in chickens contains only a single functional VH segment, a pool of about 90 VH [pseudogenes](https://www.sciencedirect.com/topics/immunology-and-microbiology/pseudogene) positioned 5′ of this segment, 16 DH segments 3′ of the functional V segment, a single JH segment, and 3 CH exons specifying [IgM](https://www.sciencedirect.com/topics/immunology-and-microbiology/immunoglobulin-m), [IgY](https://www.sciencedirect.com/topics/immunology-and-microbiology/immunoglobulin-y), and [IgA](https://www.sciencedirect.com/topics/immunology-and-microbiology/immunoglobulin-a). It should be noted that this is the first appearance of true IgA in [phylogeny](https://www.sciencedirect.com/topics/immunology-and-microbiology/phylogeny). Despite the relatively large number of D segments, very little diversification is due to D segment recombination, and V(D)J recombination in general plays only a minor role. Rather, a mutational mechanism called somatic gene conversion introduces diversity into the [antigen-binding site](https://www.sciencedirect.com/topics/immunology-and-microbiology/paratope) (see Box 21-3). During this process, a DNA “overwriting” event occurs involving the functional VH segment and one of the VH pseudogenes that slightly modifies the sequence of the functional VH segment but leaves the VH pseudogene unaltered. Since a different VH pseudogene is likely to participate in different B cells, different modifications of the functional VH sequence occur, giving rise to a sufficiently diverse B cell repertoire. Isotype switching of the CH exons results in IgM giving way to IgA or IgY in the secondary response concomitant with [somatic hypermutation](https://www.sciencedirect.com/topics/immunology-and-microbiology/somatic-hypermutation) leading to an increase in antibody affinity. Studies of Ig gene structure in ducks have confirmed that IgY is probably the common ancestor of mammalian IgG and [IgE](https://www.sciencedirect.com/topics/immunology-and-microbiology/immunoglobulin-e). In birds, IgY is a [skin-sensitizing](https://www.sciencedirect.com/topics/immunology-and-microbiology/skin-sensitization) antibody that can mediate [anaphylactic reactions](https://www.sciencedirect.com/topics/immunology-and-microbiology/anaphylaxis), highlighting its functional similarity to mammalian IgE

**IMMUNE RESPONSE WITH RESPECT TO TUMUOR AND ORGAN TRANSPLANTATION**

A variety of terms are used to define antigens and immune responses stimulated in a transplant setting according to the relationship of the donor and the recipient.

The tissues transplanted from the same individual (i.e., autografts) are termed autologous transplants since they contain autoantigens or ‘‘self’’ antigens and under normal circumstances evoke no immune responses.

An auto-graft is a transplant of self-tissue or cells, e.g., skin or hematopoietic stem cells (HSC).

[Autologous](https://www.immunopaedia.org.za/glossary/autologous/) skin transplants are often performed on burn patients, and autologous HSC transplantation is commonly used as a means of rescuing cancer patients subsequent to myeloablative chemotherapy.

The term isograft is sometimes used when referring to a syngeneic transplant between two different genetically identical individuals.

In humans, only a transplant involving identical twins would be a true syngeneic isograft.

In an animal model, a syngeneic transplant would involve two animals derived from the same inbred strain.

The term allogeneic graft refers to a transplant that involves the transfer of an allograft containing alloantigens, which are genetically controlled characteristics that differentiate one member of a given species from another.

The vast majority of transplants carried out in humans are allogeneic.

However, due to the serious shortage of donor organs, researchers are actively investigating ways to successfully perform xenotranplantation, which involves the transfer of organs or tissues, i.e., a xenograft, containing xenoantigens between members of two different species.

The immune responses involved in transplantation are governed by the laws that are based on the genetics of the donor and recipient