In response to threats of attack your body has developed an immune system, an army of specialist cells equipped with high-tech weapons (e.g. antibodies) and sophisticated communication systems. Antibodies are also known as immunoglobulins (Ig) and are 'Y' shaped proteins made by B cells.

Each antibody has a di erent 'variable' region, the top of the 'Y' shape, where antigen-recognition and binding takes place. A single pathogen can have many di erent antigens, for each there may be many antibodies. Our immune system has the potential to produce 10 billion di erent antibodies, even before it meets an invader! This diversity ensures our immune system can detect and eliminate the 1000s of pathogens we encounter each day.

There are many processes which take place to create the di erent variable regions on our antibodies. The rst process involved in generating the huge collection of antibodies is called 'V(D)J recombination', scientists at the Babraham Institute have been investigating this. The variable region (the top of the 'Y') is encoded by numerous gene segments which are known as variable (V), diversity (D) and joining (J) gene segments.

The V, D and J genes are joined together via a 'cut and paste' mechanism by two enzymes known together as the Recombinase Activating Gene, or RAG complex. There are 195 V genes, 10 D genes and 4 J genes initially the D and J genes join, followed by a V gene. Because there are so many di erent Vs, Ds and J genes many di erent combinations can be used to generate the variable antigen binding region of the antibody – producing millions of di erent antibodies which can recognise millions of di erent invaders.

Nuclear Dynamics and Immunology

Collaboration to understand our immune system

At the Babraham Institute we also study nuclear dynamics, a eld of science which investigates processes that alter gene expression without changing the DNA sequence. These include 3D organisation of chromosomes, and several epigenetic mechanisms, such as DNA looping which ensure that the gene segments are brought together correctly. Scientists at the Babraham Institute are trying to understand how the 3D architecture of antibody genes in uences V(D)J recombination. In particular we have found that these genes make a lot of non-coding RNA. Non-coding RNA doesn't make protein and 98% of the RNA in our body is non-coding. We are trying to understand how non-coding RNA in uences V(D)J recombination. Our research has already shown that as we age approximately half of our V genes are no longer used properly to generate new antibodies – leading to a reduced resistance to infection. We aim to understand which of these epigenetic mechanisms are faulty during ageing, so that we can design new treatments to boost antibody production, improving the ability of elderly people to ght infection.

For more details visit http://bit.ly/1lZSVvZ