

Immune System(s) by Dr Adrian Liston on 18-10-19

Dr Liston prefers the term Immune Systems, as the body has several mechanisms for dealing with pathogens. These are shaped by evolution, and he began with the example of cheetahs hunting gazelles – a faster cheetah will thrive, and a slow gazelle won't - so they both evolve to run faster (until other factors come into play).

Humans have white cells to defeat harmful bacteria - but bacterial evolution is subject to a new generation every 20 minutes while humans have a new generation every 20 years or so. Other things being equal humans could not win. Fortunately, humans have multiple immune systems, different in each individual, no two people having identical systems. A pathogen may kill the odd person but not others - a diverse human population is necessary to prevent a human wipe-out. Successful pathogens have evolved to continue in being without killing their hosts. However, diverse immune systems give problems relating to the treatment of conditions such as allergies, HIV/Aids and auto-immune diseases.

We are, of course, beset with many, mostly benign, bacteria – a million will be transferred when shaking hands – or 80 million with a kiss. Food and drink supply lots – gut bacteria are important.

Dr Liston has been studying blood samples looking for “flavours” of immunity - and can distinguish a hundred or so. He described two main types of immune system. Type 1 provides resistance to intracellular parasites such as viruses and bacteria, favouring older people who already have immune stability but still need to resist infections. Type 2 provides resistance to extra-cellular parasites such as worms and is more important for the very young while they build up their immunity.

Gradual changes through life, with the balance shifting from Type 2 to Type 1, mean that hay fever, for instance, may become less severe than when one was young. Exercise can change the balance the other way which may mean that there is a downside to exercise by the aged.

Dr Liston commented on the Hygiene Hypothesis, which says that the young need exposure to a range of pathogens in order to fully develop their immune systems. They may miss out in the modern world; and the effect of modern pollutants is another cause for concern – smog, for example, will affect the lungs of a small child far more than an adult.

A Belgian study found that couples (assumed to be married as they had a child) tend to be more similar than separate people. This is partly due to genetics, with just 500 people having a million variants, and 100 different immunity parameters.

How stable is a person's immune flavour? Does it change with time? 200 people were tested at six month intervals, and found to be stable. Of 50 people (willingly) going on a holiday where there was a high likelihood of catching gastroenteritis 24 remained healthy, and their immunity remained stable; 26 caught the disease, the flavour of their immunity changed significantly while they recovered, and then returned to what it had been.

Dr Liston concluded by saying about 30% of immunity is genetic, 50% due to environmental effects and age, with other factors not understood.

Chromatin Organisation & Cell Fate by Dr Clara Novo on 18-10-19

(“Fate” indicating what the cell will develop into.)

Dr Novo said the DNA molecule common to all human cells is about 2m long. However, it is folded up inside the nucleus of each cell, so that parts at different points along its length will end up adjacent to each other – and can interact.

How the folding takes place is determined by Histones, which have ‘tails’ with the ability to bond to compatible tails of other histones, and form a centre for folding. Chromatin then forms round these centres, and the DNA folds up around them, the folding pattern differing for each type of cell (liver, muscle etc). Genes within the DNA that are hidden inside the folded structure will not be expressed; while those that are accessible will be, and interact with adjacent genes. The adjacent genes need not even be in the same chromosome.

The processes that give rise to the differentiation of body cells start when the female egg is by fertilised by male sperm. Subsequent cell division is dependent on such processes. Dr Novo said there was evidence to suggest that “junk” DNA (which is conserved down the generations) had a role in this, particularly in determining which parts of the DNA should not be expressed in a particular cell. Also that RNA, formed as the agent for gene expression, has a role in organising the regions of the folded DNA.

HI-C technology has been available since 2012 to visualise the folding. One technique is to freeze DNA, cut out a part and reform it – when cross-linking to folded neighbours can take place - and note the effect.

Cancers could be due to faulty folding during cell division.

The mechanism of the ageing clock, where the telomeres at the ends of chromosomes become shorter with successive cell generations, is one of many topics of study in this field.