

Molecular biomimicry

Autoimmune diseases are a group of sinister diseases where the immune system attacks the body that it was designed to protect. One mechanism that explains auto-immune conditions is *molecular biomimicry*. When intruders invade our bodies, the immune system creates antibodies that mark these intruders (antigens) as a foreign foe. The immune system then able to destroy the intruders.

During digestion, proteins from animal-based foods are broken down into their component amino acids. Some proteins may be absorbed from the intestine without being fully broken down into their amino acid components. Small chains of amino acids are called peptides. These peptides may be treated as a foreign invader by our immune system.

Biomimicry and Type 1 Diabetes

Many proteins are similar over a wide range of both plant and animal species. For example, albumin is the most common soluble protein in the blood of animals. It is also present in egg white. Albumin from different species is slightly altered. There is a strong correlation with the level of antibodies to bovine serum albumin in the blood and type 1 diabetes. In 1990s, Finland had the highest incidence of diabetes and cow's milk consumption in the world. Researchers compared levels of incompletely digested cow's milk protein (Bovine Serum Albumin - BSA) in 142 diabetic children. Levels of IgG anti-BSA antibodies were higher than 3.55 RFUs (relative fluorescence units) for the 142 diabetic children whilst each non-diabetic child in the control group of 79 children had levels of less than 3.55. [1]

There was no overlap of the levels between the two groups of children. All children with diabetes had a higher level of the antibodies (which can only occur from consuming cow's milk) than the group without diabetes.

Significant increases in BSA antibodies in diabetic children have been found in other studies in Finland[2] and France.[3]

There is a specific sequence of 17 amino acids that is found in proteins in cow's milk - but is

different in human albumin. The immune system recognizes this sequence as a foreign intruder so antibodies are produced to eliminate the unwanted invaders. Unfortunately, the same 17 amino acid sequence is found on the cells of the pancreas that produce insulin. Consequently, the immune system is unable to distinguish the cow's milk protein fragments from the pancreatic cells. It therefore destroys both which leads to the inability of the pancreas to produce insulin and leads to a life time dependency of insulin injections and their consequences. [4]

Biomimicry and Rheumatoid Arthritis

Rheumatoid arthritis is strongly associated with urinary tract infections. This is consistent with the observation that rheumatoid arthritis occurs much more frequently in women.

The majority of urinary tract infections are caused by *Escherichia coli* (*E. coli*) bacteria. Bacteria belonging to the *Proteus* genus are the next most prevalent cause of urinary tract infections.

There is evidence that *Proteus* bacteria is also involved with rheumatoid arthritis. [5]

An amino acid sequence in a protein in *Proteus* is similar to a sequence found in collagen. Collagen is the most abundant proteins found in mammals and is the main component of connective tissue. It is found in fibrous tissues such as tendons, ligaments, skin, cartilage and bones as well as other organs. It is cartilage and bones that are affected by rheumatoid arthritis.

Amino acid sequence in bovine serum albumin (BSA) differs significantly from human albumin at positions 141-157. However, there is a close match with human collagen type I as well as C1q and vitamin D binding protein. The paper found support for the hypothesis that antibodies for BSA at the relevant positions are found in the blood of rheumatoid arthritis subjects. The paper concludes that "the possibility of a molecular mimicry mechanism" may

exist for rheumatoid arthritis. [6]

Biomimicry and Hashimoto's Disease

Graves' disease, rheumatoid arthritis and Hashimoto's disease are the three most common autoimmune diseases. Graves's disease results in an overactive thyroid and Hashimoto's disease (thyroiditis) results in an under-active thyroid.

A paper from 1976 showed a link between high levels of *Yersinia* antibodies and both Hashimoto's thyroiditis and Graves' disease . Antibodies to *Yersinia* were found in 66% of the Graves' disease patients and 100% of the Hashimoto's disease patients. [7]

Another paper showed that the prevalence of *Yersinia* antibodies was 14 times higher in people with Hashimoto's thyroiditis than in the two control groups. [8]

Yersinia infection is entirely derived from pork products. *Yersinia* is associated with a 47 times (it is not a percentage increase) increase in the rate of diseases of the joints, 2.9 times increase in ulcerative colitis and a 7.6 times increase in non-infective gastroenteritis and colitis. [9]

Footnotes

1. Karjalainen, J. et al. (1992) A Bovine Albumin Peptide as a possible trigger of insulin-dependent Diabetes Mellitus. *New England Journal of Medicine*. 327 (5), 302-307.
2. Saukkonen, T. et al. (1994) Children With Newly Diagnosed IDDM Have Increased Levels of Antibodies to Bovine Serum Albumin But Not to Ovalbumin. *Diabetes Care*. 17 (9), 970-976.
3. Levy-Marchal, C. et al. (1995) Antibodies against bovine albumin and other diabetes markers in French children. *Diabetes Care*. 18 (8), 1089-1094.
4. Karjalainen, J. et al. (1992) A Bovine Albumin Peptide as a possible trigger of insulin-dependent Diabetes Mellitus. *New England Journal of Medicine*. 327 (5), 302-307.
5. Ebringer, A. (2009) Rheumatoid arthritis is caused by Proteus: The molecular mimicry theory and Karl Popper. *Frontiers in Bioscience*. E1 (2), 577-586.

6. Pérez-Maceda, B. et al. (1991) Antibodies to dietary antigens in rheumatoid arthritis—possible molecular mimicry mechanism. *Clinica chimica acta*. 203 (2-3), 153-165.
7. Shenkman, L. & Bottone, E. J. (1976) Antibodies to *Yersinia enterocolitica* in thyroid disease. *Annals of Internal Medicine*. 85 (6), 735-739.
8. Chatzipanagiotou, S. et al. (2001) Prevalence of *Yersinia* plasmid-encoded outer protein (Yop) class-specific antibodies in patients with Hashimoto's thyroiditis. *Clinical Microbiology and Infection*. 7 (3), 138-143.
9. Ternhag, A. et al. (2008) Short- and Long-term Effects of Bacterial Gastrointestinal Infections. *Emerging Infectious Diseases*. 14 (1), 143-148.