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Unlocking secrets of the immune system

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By Aaron J. Marshall

YOUR immune system protects you from nasty infections, and without it you would have to live in a bubble to survive.

Patients who suffer from chronic diseases such as systemic lupus, rheumatoid arthritis or Crohn's disease are ill because of a malfunction of their immune system.

In these autoimmune diseases, the immune system attacks the body itself, resulting in serious health problems. Similarly, the misguided immune system of allergy sufferers and asthmatics can cause symptoms that range from annoying to life-threatening.

Why doesn't the immune system prevent us from getting sick all the time and why does it make others sick? These are the kinds of questions being tackled by immunologists at the University of Manitoba's faculty of medicine.

With autoimmune and allergic diseases on the rise, we urgently need answers. Immunologists around the world are taking a nuts-and-bolts approach to figuring out why the cells of the immune system react as they do. Scientists believe that we first need to understand what regulates the activity of the immune system, and only then can we hope to understand why things go wrong and how to correct it.

Researchers are rapidly learning more about the different types of immune cells in our bodies and how they can affect our health. Experts in the University of Manitoba's department of immunology are studying a variety of immune-cell types, including B-lymphocytes, T-lymphocytes, natural killer cells and neutrophils.

Each of these cell types plays an important role in keeping us healthy. On the other hand, unchecked activities of these same cells can have devastating consequences. For example, B-lymphocytes can produce antibodies that stop viruses (good), or they can produce antibodies that bind to pollen or even your own DNA, which leads to health problems such as asthma, arthritis and those mentioned earlier.

How do immune cells make the right decision to respond to the virus, but not the pollen? Immune cells are controlled by receptor proteins present on their surface membrane. These receptors allow the cells to look for the presence of foreign invaders, tissue damage and other activated cells. Stimulation of these receptors causes the cells to "turn on" and communicate with other cells using "immunological hormones."

The goal of much immunology research is to decipher the codes of cellular communication so that we can control it.

Our knowledge of these controls is still far from complete. Advances in genomics, proteomics and fluorescence imaging are providing amazing new tools and techniques to aid in discovery.

New control genes and proteins are being identified in large numbers. It is becoming clear that each type of immune response is controlled by unique molecular signalling codes. Researchers are piecing together the code one molecule at a time and learning that the immune response can be altered by blocking or enhancing the activities of specific proteins.

Nuts-and-bolts research discoveries represent essential first steps in major biomedical advances. These discoveries are allowing clinical researchers to learn whether changes in specific proteins may account for autoimmune or allergic diseases in their patients. Researchers have found that these changes exist and that they may be responsible for the unhealthy immune responses that make people sick.

Understanding the molecular controls and how they sometimes go wrong will allow researchers and pharmaceutical companies to develop better medicines to treat these patients. Researchers believe that by having a stronger understanding, medicines can be targeted more effectively, and with fewer side-effects. Several of these finely targeted immunosuppressive medicines are under study.

This is an occasional column written by members of the University of Manitoba's faculty of medicine. Aaron J. Marshall, Ph.D., is the Canada Research Chair in the faculty's department of immunology.
