

Summer Vacations for the Immune System

Richard Béliveau

Translated from Le Journal de Montréal, July 13, 2015

A complicated and fascinating study in the scientific journal Nature has shown that expression of several genes involved in the immune response are elevated in winter and diminished in summer, reducing the summer levels of inflammatory molecules as well as the risk of several serious diseases associated with inflammation. It is as if our immune system also takes a vacation for a few weeks during the summer season!

SEASONAL VARIATION

The **changes in climate** which accompany the seasons have a considerable influence on the lives of all species on this planet. One need only think of the seasonal appearance of flowers, the enormous distances crossed by migratory species in order to reproduce, or even the extreme variations observed in body metabolism (as in hibernating bears, for example).

In humans, numerous studies have clearly shown that the incidence of several diseases varies enormously with the seasons, with peaks observed during winter. Some which immediately come to mind are infectious diseases such as influenza, which hits hard between December and April, but several other diseases which are not due to viral or bacterial agents also show large seasonal variation. For example heart attacks, strokes, certain autoimmune disorders (type 1 diabetes, rheumatoid arthritis) and even certain psychiatric disorders (depression, schizophrenia) all occur more frequently during the cold season. Thus, it seems that certain variations in our physiological functions during the winter could promote the appearance of these serious diseases.

GENETIC VARIATIONS

All these diseases which are more likely to occur in winter have the common characteristic that they seem to be promoted by inflammatory conditions, which suggests that the immune system could play a role in this seasonal variation.

This was confirmed by the results of the largest analysis to date on variations in genetic expression which are linked to season¹. By using blood samples which had been taken at different times of the year, scientists could measure the expression levels of 22,822 genes present in the white blood cells of 16,000 individuals living in the northern and southern hemispheres of the globe. The results were quite spectacular: of the 22,822 genes measured, nearly a quarter (5,136) varied considerably with the seasons, particularly several genes known for their involvement in the immune response and in inflammation.



It was, for example, observed that certain inflammatory molecules (IL-6, CRP) were increased in winter and it is likely that inflammation associated with increases in the levels of these molecules participates in the development of several diseases. Studies have actually shown that elevated levels of the molecule IL-6 were associated with an increased risk of heart disease, type 1 diabetes and of certain psychiatric disorders; all of these pathological conditions have been shown to have a higher likelihood of occurrence in winter. This negative effect could be further enhanced since the study also showed that certain molecules which acts as natural anti-inflammatories were at their lowest levels during winter.

While the mechanisms responsible for these variations remain unknown, there is little doubt that these changes could greatly contribute to the increase in certain diseases observed during the cold months.

INFLAMMATORY PREDISPOSITION

The increase in immune activity during winter observed in this study is probably a physiological adaptation evolved to fight against infectious agents, which are particularly active during the cold seasons. It must be borne in mind that infectious diseases had, until recently, represented the principal cause of death for the human species and it is normal that our immune system developed, over the course of evolution, a greater activity during the winter followed by a well-deserved rest during the warm months.

This greater reactivity of the immune system during the cold season can, however, become problematic when it is combined with pro-inflammatory conditions such as being overweight, sedentary or with poor nutrition. We can thus profit from the summer vacation for our immune system by modifying our daily habits and adopting a healthy lifestyle which minimizes this predisposition to inflammation during the upcoming winter and also permits us to prevent several serious chronic diseases.

⁽¹⁾ Dopico XC et al. Widespread seasonal gene expression reveals annual differences in human immunity and physiology. Nat. Commun. 2015;6:7000.