How climate change affects allergies, immune response and autism

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Climate change and disruption of the ecosystem have the potential to profoundly impact the human body. Xue Ming, professor of neurology at Rutgers New Jersey Medical School, who recently published a paper in the *International Journal of Environmental Research and Public Health*

on the effects of climate change on allergies, autoimmunity and the microbiome—the beneficial microorganisms that live on and inside the human body—discusses how the delicate balance of the environment affects conditions such as allergies, autism and immune disorders.

How has climate change affected respiratory allergies?

Climate change has worsened respiratory allergic disease and has altered the immune system's tolerance in responding to toxins, which has led to an increase in the prevalence of immune diseases. People with chronic respiratory allergic disease that affects the nose and eyes, such as asthma and allergies, are at particular risk due to increased exposure to pollen and the increased concentration and distribution of air pollutants.

According to the American Academy of Allergy Asthma & Immunology, climate change has both increased the intensity of the pollen season as well as prolonged its duration. Increases in carbon dioxide were shown to lead to an increase in plant reproduction and total pollen levels, especially those plants that thrive at high carbon dioxide concentrations. For example, ragweed pollen has been increasing in concentration, with models predicting that levels will increase by four times within the next 30 years.

Thunderstorms, which have become more frequent due to rising sea temperatures, have been found to increase concentrations of pollen grains at ground level. After absorbing water, these grains can rupture and release allergenic particles that can induce severe asthmatic symptoms in patients with asthma or hay fever.

Climate change has also been linked to increased concentrations and distribution of air pollutants such as ozone, nitric oxide and other volatile

organic chemicals. There is a growing body of evidence suggesting that these airborne environmental pollutants may be partially responsible for the substantial increase in allergic respiratory disease seen in industrialized countries over the past several decades.

How do changes to the ecosystem affect allergies and respiratory disorders?

Deforestation and over-logging have led to a dramatic decrease in the diversity of plant species. As one species of plant becomes extinct, new species emerge to take their place. For example, as oak trees have been excessively harvested for architectural purposes, new species of trees have emerged. With these new trees come new forms of tree pollen, which are inhaled and ingested by humans on a daily basis.

Similarly, widespread pesticide use has altered the profile of insects, invertebrates and microorganisms with which we come into contact with through our soil and vegetation. As the environment is altered, our bodies are bombarded with novel organisms. The molecules which make up these organisms—known as antigens—are recognized as "foreign" by our bodies and create an inflammatory response.

How might a loss of biodiversity due to climate change affect non-respiratory diseases?

According to the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services, biodiversity is declining faster than at any time in human history, with nearly 1 million animal and plant species are threatened with extinction due to climate change.

The loss of biodiversity related to climate change may affect the microbiome, potentially leading to inflammatory, autoimmune and

neurologic diseases. Immunologic disorders, such as food allergies, are on the rise. For example, several studies have found that increases in carbon dioxide and temperature are correlated with changes in the composition of the peanut, making it more difficult for the body to adapt immunity.

Could disturbances in gut bacteria affect the autism rate?

Disruption of gut bacteria has been linked to neurologic diseases such as multiple sclerosis, autism and Parkinson's disease. In my own research, I found abnormal amino acid metabolism, increased imbalance between free radicals and antioxidants in the body, and altered gut microbiomes among some patients with autism spectrum disorder.

What steps can be taken to minimize the health risks brought on by climate change?

We must end the destruction of our natural environment, decrease emissions of greenhouse gases and adopt more "green" behavior. With research demonstrating links between the microbiome and autoimmune, inflammatory and neurologic diseases, it is critical that we minimize antimicrobial exposure. This may involve altering guidelines for the prescription of antibiotics by medical professionals. In addition, given that the microbiome is directly impacted by our daily environment it is important to regularly immerse ourselves in nature and familiarize ourselves with biodiverse surroundings.

More information: Carly Ray et al, Climate Change and Human Health: A Review of Allergies, Autoimmunity and the Microbiome, *International Journal of Environmental Research and Public Health* (2020). DOI: 10.3390/ijerph17134814