

Editorial

Human Immune Response and Tolerance Compensating for the Adverse Impacts of Climate Change on Human Respiratory Health and Autoimmunity

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Editorial

Climate change is a burning issue which we cannot overlook. Environmental stressors, antigens, pollens, particulate matter, ground-level ozone O₃, heat waves, wildfires, floods, drought, altered rainfall patterns, hurricanes, thunderstorms, windstorms, air pollution and increased pathogens are some climate change outcomes. Now, the problem is how the human immune responds to continuous exposure to such stressors and Pathogen-Associated Molecular Patterns (PAMPs). Our human body has evolved in such a way that innate and acquired both cell-mediated and humoral immunity adaptive mechanisms to detect and eliminate such foreign particles. The most common response to pollen exposure is manifested as allergies, in which the body responds to allergens like pollens by activating mast cells to secrete histamine. Exposure of the body, skin and lungs to allergens causes an impaired epithelial barrier, which permits entry of allergens, pollutants, antigens and bacterial endotoxins, causing the release of cytokines IL-25, IL-33 and TSLP. Th2 cytokines IL-4, IL-5, IL-9 and IL-13, in turn, activate B-cells to produce antibodies IgE, including other isotypes (IgG, IgA and IgG4) and T cells as well activate mast cells. Mast cells express a variety of receptors, including high-affinity FcεRI receptors, to recognize a wide range of foreign molecules. Two important events are possible in response to IgE-FcεRI stimulation: 1). release of proteoglycans, proteases and neuropeptides from the granules due to intracellular Ca²⁺ levels mediated by phosphorylation of Phospholipase C Gamma 1 (PLC-γ1) and 2). activation of nuclear factor kappa B (NF-κB) mediates the secretion of de novo synthesized lipid mediators and cytokines. It enhances the expression of numerous inflammation-related genes mediated by the major transcription factor. The function of all these factors is to act together in order to control inflammation. Difficult respiratory diseases, chronic respiratory allergic diseases such as asthma, sensitization to aero and food allergens and the development of eczema and hay fever,

allergic rhinoconjunctivitis and sinusitis characterized by repeated sneezing are related to inhalation of environmental stimulants pollutants, dust, smoke and toxins particles with an aerodynamic diameter of about 0.003 to 5 μm that can penetrate deep inside the alveoli of the lungs, affecting gaseous exchange and thereby reducing O₂ availability to body tissues. The gut microbiome can also be altered due to multiple climate change-related factors changing the way antigen specific suppression of immune response involving B and T-lymphocytes. Prolonged heat wave exposure is a major problem that can elicit oxidative stress by producing Reactive Oxygen Species (ROS), causing DNA damage and upregulation of Heat Shock Protein (HSP) genes expressing molecular chaperons. HSP proteins exacerbate acute and chronic inflammation. Moreover, due to climate change and environmental alterations many parts of the world are now facing increased autoimmune and autoimmune diseases. Autoimmunity is a condition in which self-cells start attacking their own cells, if pathogens are also helping in the process called autoimmune diseases. Environmental factors such as tissue damage and infection can trigger and interact with genetic factors to induce autoimmunity. The human body establishes its own adaptive mechanisms after prolonged contact with such stressors

and may become immune tolerant by deleting reactive lymphocytes and generating regulatory T (Treg) cells. The development and maintenance of immune tolerance is critical because it can cause many diseases. Our knowledge of understanding is limited as there may be multiple synergistic interactions and various factors can simultaneously act together to trigger such immune responses. We need to think beyond the horizon and expand our knowledge so that we can overcome such challenges. Targeted cytokine therapy has made tremendous progress in the treatment of patients with autoimmune diseases. We are living together with such harmful stressors and pathogens; though we wish to live in a clean environment, millions of people are suffering from viral diseases like Zika and hay fever from inhalation of ragweed pollen. Grass, herbs and trees are producing varieties of pollens as temperature and CO₂ availability to plants are sufficient due to increased greenhouse gas emissions and global warming. Due to human over-exploitation for fossil fuel and natural resources by deforestation, urbanization, habitat fragmentation and destruction, humans are the ones inducing climate change and, in turn, facing serious health conditions just like being trapped in their own set net. Sustainable use of nature and natural resources is the key to mitigating the detrimental effects of climate change not only for the present generation but for future generations to come. If we do not take immediate action plans, then we are going to face worse scenarios than what we have seen today. Even we are not able to breathe fresh air and go to morning work, we need to stay indoors. In such a situation, we need to construct huge eco-friendly environment-friendly buildings provided with attached air purifiers and air conditioners throughout the year. In India, the capital city, Delhi faces maximum air pollution due to smoke and clouds of dust coming from established industries because of it school, colleges other HEIs, offices declared holiday by Government of India. Manipur, in the North-Eastern part of India, reported increased autoimmune cases in recent years, which may be because of longer photoperiod and pollen persistence in the air due to deforestation, zoom cultivation and forest firing and disturbed rain patterns. Providing alternative livelihood, giving awareness, government policies and programs, as well as community involvement become necessary to check such unwanted practices. As human beings, it is our duty to safeguard our environment, natural ecosystems and surroundings, including living organisms, to enrich biodiversity for co-existence in a self-sustaining, stable climax community. World leaders need to come forward collectively to act in coordination and collaboration because we are living in a lone Mother Earth. Government policy and programs need to be amended from time to time and funding is also mandatory to mitigate and adapt to such climate change. We are now living in the age of Artificial Intelligence (AI) and we should make use of it to come up with a groundbreaking innovation or noble idea that can be the solution to what the world is facing today. When our environment is clean, our body will also be healthy, with the normal physiological functioning of the immune system without disease and sound mental health. One world, one home, one environment, one life, one humanity should be the motto of our living and only peace and harmony prevail between different creeds and castes and different religions. Our mother earth will be a beautiful place to live comfortably.

Keywords: Vaccine Effectiveness; Autoimmune; Prospective Cohort; Health Care Workers; Neutralizing Antibody

Conflict of Interest

The authors declare no conflict of interest.

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