

Environmental endocrinology: Expanding spectrum, evolving science

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Environmental Health

Humans are surrounded by, and live in, their environment. The World Health Organization defines environment (in relation to health), as “all the physical, chemical and biological factors external to a person, and all related behaviours”.¹ The environment impacts our health in multiple and interlinked ways. As a corollary, we can modify our environment to improve our health as well.

Environmental health is a subdiscipline of public health, which aims to prevent disease, as well as promote the environment, minimizing hazardous physical, chemical and biological agents, and limiting exposure to them. The NEHA (National Environmental Health Association) defines environmental health as “the science and practice of preventing human injury and illness and promoting well-being by identifying and evaluating environmental sources and hazardous agents and limiting exposures to hazardous physical, chemical, and biological agents in air, water, soil, food, and other environmental media or settings that may adversely affect human health”

Socio-Environmental Health

Current global concerns, such as the COVID 19 pandemic, have led to an increasing focus in environmental health. Though COVID 19 is a biological agent, physical and chemical factors play a major role in promoting or mitigating its spread. The epidemic has also shown a spotlight to the importance of social environment in modifying the spread of disease. Though most environmental health definitions exclude the domain of psychosocial health, an environmental health professional is expected to “engage community members to understand, address and resolve problems”.² This underscores the need to include social aspects in the environmental approach to health.

Environmental Endocrinology

The main elements of environmental health include outdoor air activity, surface and ground water activity, toxic substances and hazardous wastes, homes and buildings, as well as health infrastructure and surveillance. Superficially, environmental health may seem linked to infectious

diseases, road traffic accidents and respiratory diseases. However, this discipline has a close relationship with endocrinology as well.

Environmental elements are known to influence medical and metabolic health. The internal hormonal homeostatic system responds to cues from the external environment, and may become dysfunctional if the environmental is suboptimal. These interactions, which operate in both health and disease, are the focus of science of environmental endocrinology. Environmental endocrinology is defined as the study of how the environmental conditions experienced by an organism affect the endocrine system, as well as how the endocrine system regulates the interactions of organisms (e.g., behaviour) with their environment.³

Endocrine Disruptor Chemicals

Endocrine disruptor chemicals are perhaps the most obvious face of environmental endocrinology.⁴ Exposure to harmful chemicals (the Stockholm Dirty Dozen, for example), may lead to a variety of neuro-endocrine and reproductive diseases. The 5Pmnemonic (Plastics, Paints, Pesticides, Pollutants and Phones [[mobile phones]]) helps us remember the common sources of such endocrine disruptor chemicals.

Endocrine Rhythms

Endocrine rhythms are intrinsic to the maintenance of homeostasis. Most of such rhythms are free-running, i.e., independent of the external environment. Others, however, are entrained by environmental cues, such as light /dark changes, day/night length, meal patterns and intake, and lunar cycles.⁵ The increasing prevalence of shift work has led to interest in shift work biology, and its impact on endocrine health.⁶ The role of day/night cycling in melatonin secretion is another facet of environmental endocrinology.⁷

Influence on Pathogenesis

Sunlight directly influences Vitamin D sufficiency, and exposure to sunlight cannot be ignored while studying environmental endocrinology.⁸ Similarly, iodine status, which impacts thyroid health, is an important focus of this discipline.⁹ Other environmental factors such as radiation may also lead to thyroid disease, including thyroiditis and carcinoma. The Chernobyl and Fukushima reactor

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accidents are examples of sudden catastrophes in environmental endocrinology.¹⁰

More often than not, however, endocrinology faces insidious challenges. Slow exposure to endocrine disruptor chemicals can lead to a variety of neurodevelopment, endocrine and metabolic abnormalities. The thyroid and reproductive systems are especially prone to such endocrine disruption. Other glands are not spared, however: Obesogens and diabetogens predispose to obesity and dysglycaemia,^{11,12} just as pathogens cause infectious disease.

The external environment is closely linked with exposure, and susceptibility, to infectious agents. Infections, in turn, have a complex, multifaceted relationship with many endocrinopathies such as diabetes and obesity.¹³

Environmental factors also contribute to induction of puberty, maintenance of reproductive/sexual function, and attainment of menopause. The andro-accelerator hypothesis has been proposed as a quasi-environmental etiology for hyperandrogenic behaviour in middle aged men.¹⁴

The adrenal gland too, is closely linked with the environment. External cues trigger the release of catecholamine's and cortisol, and may be associated with the pathogenesis of pheochromocytoma crisis and cyclic Cushing's syndrome as well.

Effect on Management

Our environment also influences the management of endocrine disease. A healthy and safe environment is a pre requisite to lifestyle modification, which forms the bedrock of most endocrine and metabolic management strategies. Diabetes-friendly cities, for example, should be able to provide ample space for physical activity, exercise and recreation.¹⁵ Healthy, affordable and appealing food options, along with a stress-free environment, are necessary for good metabolic health as well. Access to clean air and drinking water is necessary to prevent infections in persons who are susceptible to these.

Availability and accessibility of preventive and curative health care services, which offer endocrine as well as comprehensive care, is another environmental aspect that influences endocrine health.

Summary

The physical environment is an important determinant of endocrine health. As we work for global health, we must remember the importance of environmental endocrinology. While advocating for good endocrine care, we must make efforts to optimize external environmental factors, to promote endocrine health, as well as prevent and manage endocrine disease.

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