

## From Newtonian concepts to a quantum understanding: The evolution of endocrinology and metabolism

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### Abstract

Conventional endocrinology is based upon linear or Newtonian feedback mechanisms. This framework helps in learning and sharing science in a lucid and simple manner, just as Newton's Laws clarified our understanding of physics.

Modern endocrinology and metabolism are more confusing, as exemplified by the multifarious etiopathogenic factors that continue to be unearthed for various diseases, such as obesity and diabetes. These diseases tend to follow a model similar to that of quantum physics. We propose a Quantum theory of baro-mechanics to help understand the complexity that surrounds metabolic disease, especially obesity. Hopefully, this insight will help mitigate the frustration that one encounters while managing these conditions.

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### Introduction

Science has evolved over the past few centuries, creating new hypotheses and discarding old theories, to enhance our understanding of the world that we live in. One example of such a change is physics. Newton's laws, of which, one posits that each and every action has an equal and opposite reaction, were earlier thought sufficient to explain all processes and events in physics.<sup>1</sup> Quantum physics, however, puts forward a novel concept: that energy and mass are relative terms for the same, interchangeable entity.

While quantum physics was derided initially, it has come to be accepted as part and parcel of modern science now.<sup>2</sup> A similar trend seems to be emerging in endocrinology and

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metabolism. Traditional endocrinology has been quite Newtonian in its thought process: hormone secretion leads to negative feedback, which if equal and opposite, keeps the hormonal concentration in dynamic equilibrium, or in homeostasis.<sup>3</sup> Exceptions have been identified, such as the positive feedback associated with luteinizing hormone surge at ovulation, oxytocin and uterine contractions, and prolactin and lactation, but these are easily explained in Newtonian terms: the hormone secretion does lead to an equal and expected reaction.

A similar theory has been accepted conventionally: if energy intake and expenditure do not match, weight gain or weight loss will occur. This linear or Newtonian attitude has characterised our approach to obesity, and has contributed to a judgmental mindset against person living with obesity. A dissimilar situation has occurred in diabetes, with the Ominous Octet and Dirty Dozen replacing insulin deficiency as the etiologic drivers of dysglycaemia.<sup>4</sup>

The discovery of newer hormones, neurotransmitters and cytokines is challenging the way in which we view endocrinology and metabolism. Many persons with endocrinopathy have clinical presentations that are not concordant with the degree of biochemical abnormality. An example would be subclinical hypothyroidism, where patients may be asymptomatic, as opposed to patients treated for Hashimoto's thyroiditis, in which patients may complain of dissatisfaction or unhappiness, in spite of achievement of biochemical euthyroidism. Yet another example is diabetes care, where multiple factors, including psychosocial and biomedical, interact to influence the response to a particular glucose-lowering therapy. These, as well as other issues call for the practice of person centred care in endocrinology.<sup>5</sup>

Awareness and appreciation of the quantum nature of physics, as well as endocrinology, allows one to evaluate and unravel the complexity of weight balance and obesity management. While baro-physics (the physics of weight) follows the Newtonian principle of energy intake/expenditure balance to a certain extent, multiple factors, many of which we are unaware of, contribute to the heterogeneity of the clinical course, and clinical care. This understanding has encouraged not only a multipronged treatment strategy for obesity<sup>6</sup> but a comprehensive

approach to the evaluation of the syndrome.

Though Einstein's Theory of Relativity states that energy and mass are interrelated, the theoretical constant that links them ( $E=mc^2$ ) does not seem to be constant across persons living with obesity. This is because adipose tissue mass is regulated not by a single, linear feedback mechanism, but by a complex, multifaceted system which continues to grow in dynamism and detail.<sup>7</sup> The ABCDE model of baro-phenotypic characterisation assists in a 'quantum' evaluation of obesity, and in planning management strategies as well as targets.<sup>8</sup> The lack of a single therapeutic target precludes the use of a single class of drugs for management. Therefore, a combination of tools and techniques is usually required to manage obesity.

### Summary

The quantum theory is a useful prism through which one can view and evaluate complex endocrine and metabolic disease. The view shared in this article should help improve our approach to these conditions, especially obesity.

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