

## Stability Analysis for an Extended Model of the Hypothalamus-Pituitary-Thyroid Axis

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**Abstract :** We formulate and analyze a mathematical model describing dynamics of the hypothalamus-pituitary-thyroid homeostatic mechanism in endocrine system. We introduce to this system two types of couplings and delay. In our model, feedback controls the secretion of thyroid hormones and delay reflects time lags required for transportation of the hormones. The influence of delayed feedback on the stability behaviour of the system is discussed. Analytical results are illustrated by numerical examples of the model dynamics. This system of equations describes normal activity of the thyroid and also a couple of types of malfunctions (e.g. hyperthyroidism).

**Keywords :** mathematical modeling, ordinary differential equations, endocrine system, delay differential equation

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