Abstract:

"A theory is given for circumnutations in plants, especially hypocotyls of Helianthus annuus, which were used as experimental material.

"The theory is based on the lateral auxin transport, which arises when a gravitational force component acts on the plant. With a suitable time delay between stimulus and response, oscillations or circumnutations should arise. It is possible to describe these oscillation phenomena by the solutions of a differential equation, derived in this paper. The time delay has a central role in this equation.

"The time delay is assumed to be identical with the geotropic reaction time for the hypocotyls. The ratio between the periodic time for the circumnutations and the reaction time for geotropic curvatures was found to be approximately constant in the temperature region investigated (namely 15-40 degree C which supports the theory. Different methods of recording the circumnutations were used, 8 mm film camera technique being the most frequently employed.

"The introduction of a weighting function for describing the plants "memory" of the stimulation makes it possible to relate the periodic time of the circumnutations to the reaction time for geotropic curvatures. The necessity of this weighting function as well as of the time delay in the equations is emphasized. An explanation of the "Funfphasen-bewegungen", reported in the literature, is presented."

Here a simple and then more complicated model is posed for the turning of a plant as it grows, i.e., circumnutation. Data is offered and the models are compared. Introduction of a delay in the time it takes a chemical to travel in the stem of the plant makes the model agree with data better. First order differential equations are used.

Keywords: circumnutation, plant, turning, delay, differential equation, model, oscillation, first order