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MENSTRUATION CYCLE RESEMBLES PARAMETRIC OSCILLATION AND SUBJECT TO EXACT PREDICTION: MATHEMATICAL MODEL EXPLAINING HYPOTHALAMIC BEHAVIOR IN RESPONSE TO STRESS, MULTIPLE PREGNANCIES RISK AND EXTERNAL STIMULI

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Objectives: Reproductive events (cycle length, ovulation) behave regularly in some and chaotic in others. A mathematical model based on empirical data is developed to predict these parameters and hypothalamic oscillations with enough exactness

Materials and methods: Thirty eight cases were evaluated by autoregressive moving average and laboratory study of a series of hormones.

Results: Cycle to cycle correction with noise is the best model fit to both very regular and very irregular patients. Addition of two hormones (estradiol and GnRH twice) at any time during the cycle can predict the time of the next menstruation with an exactness of 10h and fertility based on the simplified formula:

$$T_1 = T_0 + k \int [\Omega(\text{Est} - d_0 \text{GnRH}_0 / \text{GnRH}_1, dt)]$$

Conclusions:

1. The hormonal armamentarium of the female reproductive systems ensures single ovulation and single pregnancy.
2. Unlike bone marrow ovaries do not possess a stochastic mechanism and rely solely on suppression of nearby follicles by the dominant follicle.
3. Hypothalamus senses the risk of MP and adjusts pulsation of GnRH in the consecutive cycle by prolonging the low and postponing the high frequency pulsation. Like electric circuits, external stimuli have a changing strength of 1/4 to 1/15 meaning that they can advance or retard ovulation in this range (percentage of the innate cycle of that person).
4. The strongest predictor and determining parameter affecting menstruation cycle is sensing the MP risk by the hypothalamus exemplifying itself as frequency of GnRH pulsation ($d_0 \text{GnRH}_0 / \text{GnRH}_1, dt$).
5. Menstruation cycle and fertility can be predicted by mathematical formulas of parametric oscillation.