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Electromagnetic Biology and Medicine (formerly Electro- and Magnetobiology)

**Publisher:** Taylor & Francis**Issue:** Volume 24, Number 3 / 2005**Pages:** 265 - 272**URL:** [Linking Options](#)**DOI:** 10.1080/15368370500379632**Fröhlich System with Modulated Access to Pumping Source**

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**Abstract:**

Vibrating polar molecular entities in biological cell's interior can emit electromagnetic radiation. Fröhlich postulated rate equations for occupancy numbers,  $n_i$ , of the vibration modes which can be written as  $\dot{n}_i = s_i - [n_i] \Phi - [n_i(n_i n_j)] \chi$ , where, on the right side, the first term represents the rate of change of the occupancy number due to energy supply, the second due to linear, and the third due to nonlinear interactions with the heat bath. In previous work, we applied a diagrammatic method to bring out the feedback features of this model in the case when all modes have equal access to the pumping source. This approach is generalized by assuming that modal pumping rates are dependent on occupation numbers according to formula  $s_i = sn_i / (n_i + a_i)$  ( $a_i$  being a constant), which expresses the idea that oscillators first must be primed in order to absorb the available energy in full extent. Results suggest marked differences in behavior of oscillators with different frequencies.

**Keywords:**

Bioelectromagnetic emission, Feedback relationships, Fröhlich model, Signal flow diagrams

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