Proton De-excitation Bioluminescence

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Recent progress in the understanding of proton conductivity (1) has led to the conclusion that, quite generally, in proton translocation processes two cases have to be distinguished: the motion of excess protons, $H^{\bullet}$, and that of defect protons, H', carriers of positive and negative charges respectively (2). The highly energized species $H^{\bullet}$ can be visualized as protons on a conduction band (CB). In experimentally verified cases (3,4) this CB lies above the n=5 or n=6 vibrationally excited state of the O-H bond. When the protons on the CB de-excite by being trapped on proton acceptor sites, non-radiative mechanisms prevail. However, the $H^{\bullet}$ must also have a non-vanishing probability to de-excite optically by emitting photons the high energy edge of which will correspond to the protonic band gap. In addition a series of emission maxima is expected at energies corresponding to the band gap minus the vibrational OH excitation states.

Fig. 1 shows the so-called ultraweak luminescence observed from living cells, sometimes referred to as "mitogenetic radiation", and interpreted so far on the basis of an electromagnetic standing wave in a resonator cavity of molecular dimensions (5). This interpretation appears non-realistic. Instead we propose that the observed luminescence spectrum is due to optical de-excitation of $H^{\bullet}$ on oxygen proton acceptor sites. We predict three more emission maxima at the energies indicatied in Fig. 1 and a shift of the maxima upon deuteroxylation.

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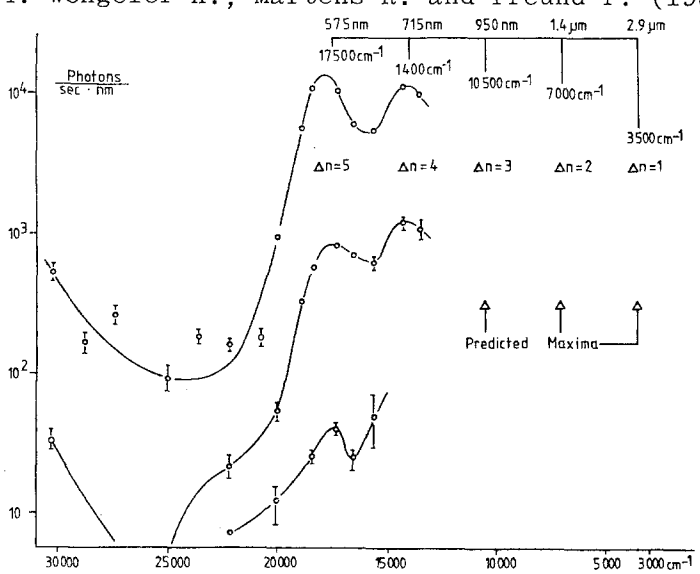

FIG. 1
Ultraweak luminescence of cucumber seedlings redrawn after (5)