Spectral categories in the learning behaviour of blowflies.

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Wavelength discrimination in the flower visiting blowfly Lucilia spec. was investigated in an attempt to elucidate the mechanisms underlying colour vision in this insect. The flies were subjected to a classical conditioning procedure in which they had to discriminate between a rewarded and an unrewarded monochromatic light stimulus. The results reveal large wavelength ranges within which no discrimination occurs, between which, however, a very distinct discrimination is found. The first range consists of the UV region up 400nm (UV). The second range comprises wavelengths between 400nm and 515nm (BLUE) and the third range all wavelengths longer than 515nm (YELLOW). A simple model consisting of two colour opponent subsystems (R7p/R8p and R7y/R8y) can explain these results. Each of the two subsystems is assumed to evaluate only whether the sign of the difference between the excitations of R7 and R8 is positive or negative. For the whole system there are thus four possible conditions: p+y+, p+y-, p-y+, p-y-. Three of them correspond to the experimentally obtained wavelength ranges. The fourth condition (p-y-) might represent a still hypothetical PURPLE category in which the stimulus is made of both short and long wavelengths.