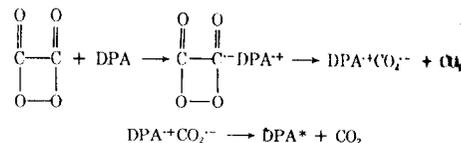


Absorption and fluorescence spectra of 9,10-bis(phenylethynyl)anthracene (11).

- high quantum yields require H_2O_2 (replacing H_2O_2 with *t*-butyl hydroperoxide or peroxybenzoic acid gives weak chemiluminescence);
- reaction of an active oxalate with H_2O_2 in an evacuated system with a pad moistened with fluorescer above the solution results in a nonluminescent solution, but brightly lit pad, indicating formation of a volatile chemiluminescent intermediate. (II) is not expected to be volatile and (III) is proposed as the intermediate causing fluorescer excitation.

Some experiments (3) require that the fluorescer, acting as an energy acceptor, function as a catalyst for the decomposition of the chemiluminescent intermediate. If the Woodward-Hoffmann symmetry rules are obeyed, the concerted decomposition of (III) would produce an excited product. Concerted decomposition in conjunction with a fluorescer requiring 70 kcal/mole or less for excitation would be favored. Decomposition of a charge-transfer complex between (III) and a fluorescer could provide a short-lived carbon dioxide-fluorescer mixed eximer capable of dissociation to ground-state CO_2 and excited fluorescer.

McCapra (10) thought it reasonable to assume that the highly strained and potentially extremely energetic dioxetanedione is preserved for sufficiently long by orbital symmetry prohibitions as to react by a lower energy pathway involving formation of the easily accessible first excited singlet state of the fluorescer. He (10) mentions that an interesting possibility for the excitation step might be the electron transfer luminescence



where: DPA = diphenylanthracene.

Rauhut (5) suggested that the excitation step involves initial formation of a charge-transfer complex between the intermediate and fluorescer, with the fluorescer acting as an electron donor. Experimentally this is supported since the rate of excitation increases as the ionization potential of the fluorescer decreases.

Fluorescer (6)

9,10-bis(phenylethynyl)anthracene is a bright yellow green fluorescer. In benzene, its fluorescence short-wavelength band, λ_{max} , is at 486 nm with an absolute fluorescence quantum yield, ϕ_F , of 0.96 einstein/mol. The absorption long wavelength band is $\lambda_{\text{max}} = 455$ nm, with $\log \epsilon = 4.52$.

The absorption and fluorescence curves for 9,10-bis(phenylethynyl)anthracene are reproduced (11) in the figure. The fluorescence spectrum represents relative photon flux per unit wave number increment and the absorption curve represents the molar extinction coefficient ($l \text{ mole}^{-1} \text{ cm}^{-1}$) versus wave number (11).

The mild electron accepting phenylethynyl group produces unusually large red shifts (for the parent hydrocarbon, fluorescence emission is at 388 nm). The large spectral shifts by phenylethynyl substituted acenes indicate substantial electron delocalization through the $-C\equiv C-$ group in the excited state, and significant lowering of the first excited singlet state relative to the ground state. Neither the ground state nor the excited state is sterically hindered.

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An Aid to Molecular Sequence Studies: Use of Ceramic Magnets to Visualize Sequences of Peptides, Proteins, and Nucleic Acids 274

Sequence analysis for research and teaching purposes involves the construction and comparison of many structures. A method is described here that utilizes colored ceramic magnets to visualize the sequences of peptides, proteins, and nucleic acids. We have found it very useful in teaching protein and nucleic acid chemistry. This system facilitates the observation of similarities and differences in structure that are of functional or evolutionary importance. It can also be used to record progress made during sequence determination and has the flexibility to accommodate changes or to correct mistakes.

The magnets were purchased from Rol-A-Chart Co. (P.O. Box 367, Diamond Springs, CA 95619). One letter amino acid or nucleotide abbreviations¹ and numbers were imprinted on rectangular magnets ($1/2" \times 1/6" \times 1/4"$) using pica 18 pt dry transfer letters (Letraset No. 728, England). The letters and numbers were permanently bonded by overspraying the magnet with clear acrylic paint (Krylon Crystal Clear 1301, Borden, Inc., Columbus, OH 43215). The total cost per magnet is about 20 cents. They can be displayed on a steel board covered with white enamel paint.

When comparing two or more sequences, one can denote where a mutation has occurred and whether the mutation is conservative by using magnets of different colors or by using circular magnets.

Contribution of the Department of Biochemistry, Kansas Agricultural Experiment Station, Manhattan, KS 66506. Mention of a proprietary product in this paper does not imply approval by the USDA to the exclusion of other products that may also be suitable.

¹ Dayhoff, M. O., "Atlas of Protein Sequences and Structure," The National Biochemical Research Foundation, Silver Springs, MD, 20007, 1972, Vol. 5, pp. D-2 and D-329.

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