Singlet oxygen production from photodynamic sensitizers†

C. S. FOOTE and D. C. DOBROWOLSKI
Department of Chemistry and Biochemistry, University of California, Los Angeles, CA 90024 (U.S.A.)

There is a wide range of naturally occurring photodynamically active compounds from plant sources. Examples include the fungal pigment cercosporin and a variety of plant polyacetylene derivatives. These compounds probably serve to protect the synthesizing organism from animal (mammal or insect) browsing, or, in the case of cercosporin, to promote the attack of the *cercospora* fungus on the target cell. Another interesting compound is 4-thiouridine, a nucleoside found in transfer ribonucleic acid of certain wild-type *Escherichia coli* strains. This nucleoside appears to be the sensitizer in an oxygen-sensitive near-UV photodynamic single-strand breakage of deoxyribonucleic acid in these organisms.

Using the 1268 nm emission from singlet oxygen, it is relatively simple to quantitate the production of singlet oxygen from many sensitizers. The sensitizer is excited by a short pulse from an Nd:YAG laser, and the weak luminescence from singlet oxygen is detected in a time-resolved system. The intensity of the luminescence is compared with that produced from a sensitizer with a known singlet oxygen quantum yield. These quantum yields are checked by measuring the quantum yield of photo-oxidation of typical singlet oxygen acceptors; the results of the control experiments agree well with those of the luminescence experiments in all cases so far studied. Using this technique, cercosporin, terthienyl and 4-thiouridine have all been found to produce singlet oxygen in solution in substantial yields.

The efficient production of singlet oxygen from these sensitizers is a necessary but not sufficient condition for the intermediacy of singlet oxygen in photodynamic damage sensitized by these compounds, *i.e.* singlet oxygen production could be only a side reaction accompanying the actual photodynamic processes. The strong protective effect of singlet oxygen quenchers against damage mediated by cercosporin and terthienyl makes it nearly certain that singlet oxygen is the active species with these pigments. However, further work will be required for the 4-thiouridine case, since the effects of inhibitors do not seem to be totally explicable on the basis of a pure singlet oxygen mechanism.

Active oxygen chemistry of ocular tissues†

S. ZIGMAN
Opthalomology Research Laboratory, University of Rochester, Rochester, NY 14642 (U.S.A.)

Because they must receive and absorb much radiant energy to perform their visual functions, ocular tissues must also be capable of protecting themselves against free radicals and oxidation products that would destroy them. While only low levels and limited wavelengths of light are required for vision, excessive quantities and visually useless light enter the eye and are absorbed by various tissues whose function is to deliver the high quanta necessary for vision to occur. Besides these considerations, it is important to

†Abstract of a paper presented at the COSMO 84 Conference on Singlet Molecular Oxygen, Clearwater Beach, FL, U.S.A., January 4 - 7, 1984.

0047-2670/84/$3.00