-continued

```
Ile Gly Val Arg Glu Met Tyr Asn Ser Leu Gly Val Pro Val Pro Gly
                85                  90                  95

Met Val Glu Ser Ile Arg Cys Leu Lys Glu Ala Ser Leu Thr Leu Leu
            100                 105                 110

Asp Glu Glu Asp Ala Lys Lys Thr Ala Pro Tyr Phe Asp Tyr Ile Ile
        115                 120                 125

Gln Ala Met Ser
    130
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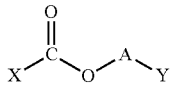
1.-**20**. (canceled)

21. A system for determining interactors that interact with a protein of interest comprising:

a SOG-POI protein comprising a singlet oxygen photosensitizer fused to a protein of interest, wherein the singlet oxygen photosensitizer is capable of producing singlet oxygen ($^1O_2$) when illuminated with a light source; and an interactor detection molecule according to the formula:



wherein:

X is a label;

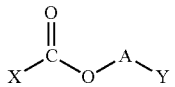
A is an optional linker wherein the linker A is a C_1-C_{10} alkylene, an aryl, or a heteroaryl; and

Y is a reactive group capable of interaction with a cysteine, lysine, histidine, or serine side chain upon oxidation by a singlet oxygen ($^1O_2$).

22. A cell comprising:

a SOG-POI protein comprising a singlet oxygen photosensitizer fused to a protein of interest, wherein the singlet oxygen photosensitizer is capable of producing singlet oxygen ($^1O_2$) when illuminated with a light source; and

an interactor detection molecule according to the formula:



wherein:

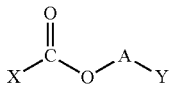
X is a label;

A is an optional linker wherein the linker A is a C_1-C_{10} alkylene, an aryl, or a heteroaryl; and

Y is a reactive group capable of interaction with a cysteine, lysine, histidine, or serine side chain upon oxidation by a singlet oxygen ($^1O_2$).

23. A method for determining interactors that interact with a protein of interest comprising:

a) introducing into a cell a SOG-POI protein and an interactor detection molecule according to the formula:



wherein:

X is a label;

A is an optional linker wherein the linker A is a C_1-C_{10} alkylene, an aryl, or a heteroaryl; and

Y is a reactive group capable of interaction with a cysteine, lysine, histidine, or serine side chain upon oxidation by a singlet oxygen ($^1O_2$),

wherein the SOG-POI protein comprises a singlet oxygen photosensitizer fused to a protein of interest, and wherein the singlet oxygen photosensitizer is capable of producing singlet oxygen ($^1O_2$) when illuminated with a light source;

b) illuminating the singlet oxygen photosensitizer with a light source, thereby producing singlet oxygen ($^1O_2$) that oxidizes the interactor detection molecule to form a reactive detection intermediate, wherein the reactive detection intermediate binds with a interaction protein that interacts with the protein of interest, thereby labeling the interactor; and

c) characterizing the interactor.

24. The method of claim **23**, wherein the c) characterizing is carried out by isolating the interactive intermediate bound interactors and the interactor is sequenced by mass spectrometry.

25. The method of claim **24**, wherein X of the interactor detection molecule is a biotin and isolation of the interactive protein is performed using a substrate attached to streptavidin.

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