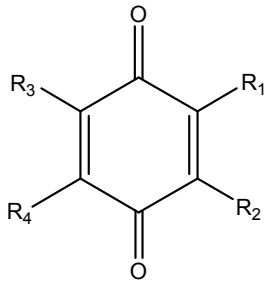
WHAT IS CLAIMED IS

1. A system comprising at least one chamber being in controllable fluid communication with a sensing compartment, said at least one chamber being configured to contain a fluid and said sensing compartment comprising a semiconductor nanostructure and a functional moiety covalently attached to said nanostructure,

said functional moiety being a redox reactive moiety which, upon contacting a redox reactive agent, a change in the oxidation number of one or more of its atoms occurs, such that upon contacting said redox reactive agent, said nanostructure exhibits a detectable change in an electron density on a surface of said nanostructure,

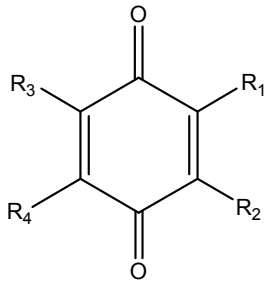
wherein said functional moiety comprises a quinone represented by the Formula:



wherein R_1-R_4 are each independently selected from the group consisting of hydrogen, alkyl, aryl, cycloalkyl, halo, trihaloalkyl, alkoxy, carboxy and other chemically compatible substituents, or, alternatively, R_1 and R_2 and/or R_3 and R_4 form together a substituted or unsubstituted 5-membered or 6-membered aromatic, heteroaromatic, alicylic or heteroalicyclic ring,

and wherein said redox reactive agent is a reactive oxygen species or an agent producing a reactive oxygen species.

2. The system of claim 1, wherein said functional moiety comprises an aromatic quinone represented by the Formula:



wherein R_1-R_4 are each independently selected from the group consisting of hydrogen, alkyl, aryl, cycloalkyl, halo, trihaloalkyl, alkoxy, carboxy and other chemically compatible substituents, and wherein R_1 and R_2 and/or R_3 and R_4 form together a substituted or unsubstituted 5-membered or 6-membered aromatic ring.

3. The system of claim 1 or 2, wherein said functional moiety comprises a functional group selected from the group consisting of quinone, benzoquinone, anhraquinone, and phenanthrenequinone, each being substituted or unsubstituted.

4. The system of any one of claims 1-3, wherein said nanostructure is a nanowire.

5. The system of any one of claims 1-4, wherein said semiconductor nanostructure comprises silicon.

6. The system of any one of claims 1-5, further comprising a detector constructed and arranged to determine said change in electrical property.

7. The system of any one of claims 1-6, wherein said semiconductor nanostructure forms a transistor.

8. The system of any one of claims 1-7, comprising a plurality of said nanostructures.

9. The system of claim 8, wherein said nanostructures are substantially identical.

10. The system of claim 8, wherein said nanostructures are included in the same sensing compartment and are in fluid communication thereamongst at all times.

11. The system of any one of claims 1-10, further comprising a substrate onto and/or into which said nanostructure is, or said plurality of nanostructures are, deposited.

12. The system of any one of claims 1-11, comprising at least two chambers, each being configured to contain a fluid and being in fluid communication with said sensing compartment.

13. The system of claim 12, wherein said at least two chambers are in fluid communication therebetween.

14. The system of any one of claims 1-13, further comprising a valve configured to control a fluid communication between each of said chambers and said sensing compartment and/or between said chambers.

15. The system of any one of claims 1-14, wherein said fluid communication is effected by means of microchannels.

16. The system of any one of claims 1-15, further comprising at least one valve for respectively allowing or preventing flow from said at least one chamber to said sensing compartment.

17. The system of claim 16, further comprising a controller, for selectively operating said at least one valve to control flow of fluids from said at least one chamber to said sensing compartment.

18. The system of any one of claims 1-17, comprising at least one chamber which holds a fluid selected to provide conditions under which said redox reactive agent is generated.

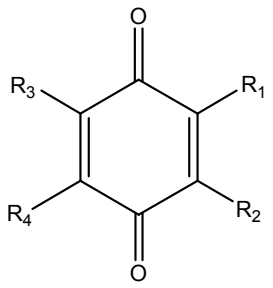
19. The system of any one of claims 1-18, further comprising an additional sensing device.

20. The system of claim 19, wherein said additional sensing device comprises an optical sensing device.

21. The system of claim 19 or 20, further comprising an additional chamber being devoid of said semiconductor nanostructure and also in fluid communication with said at least one chamber, wherein said additional sensing device is configured to receive signals from said additional chamber.

22. A method of determining a presence and/or amount of a redox reactive agent in at least one fluid sample, the method comprising introducing the at least one sample to the sensing system of any one of claims 1-21, wherein said detectable change in said electron density is indicative of the presence and/or amount of the redox reactive agent in each of said at least one sample,

wherein said functional moiety comprises a quinone represented by the Formula:

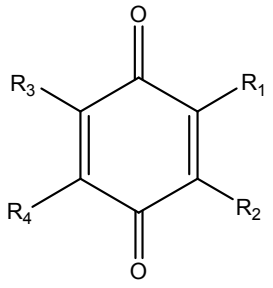


wherein R_1-R_4 are each independently selected from the group consisting of hydrogen, alkyl, aryl, cycloalkyl, halo, trihaloalkyl, alkoxy, carboxy and other chemically compatible substituents, or, alternatively, R_1 and R_2 and/or R_3 and R_4 form together a substituted or unsubstituted 5-membered or 6-membered aromatic, heteroaromatic, alicylic or heteroalicyclic ring,

and wherein said redox reactive agent is a reactive oxygen species or an agent producing a reactive oxygen species.

23. A method of determining a presence and/or amount of a substance producing a redox reactive agent in at least one fluid sample, the method comprising introducing the at least one sample to the sensing system of any one of claims 1-21, wherein said detectable change in said electron density is indicative of the presence and/or amount of the substance in each of said at least one sample,

wherein said functional moiety comprises a quinone represented by the Formula:



wherein R_1-R_4 are each independently selected from the group consisting of hydrogen, alkyl, aryl, cycloalkyl, halo, trihaloalkyl, alkoxy, carboxy and other chemically compatible substituents, or, alternatively, R_1 and R_2 and/or R_3 and R_4 form together a substituted or unsubstituted 5-membered or 6-membered aromatic, heteroaromatic, alicylic or heteroalicyclic ring,

and wherein said redox reactive agent is a reactive oxygen species or an agent producing a reactive oxygen species.

24. The method of claim 23, further comprising subjecting at least one fluid sample to a reaction condition under which said substance produces said redox reactive agent.

25. The method of claim 24, wherein said subjecting comprises fluidly communicating said chamber with a chamber which provides said condition.

26. The method of claim 24, wherein said subjecting comprises fluidly communicating a chamber which provides said condition with said sensing compartment.

27. The method of claim 25 or 26, wherein said condition comprises an enzymatic reaction that catalyzes a production of said oxidizing agent or said reducing agent by said substance.

28. The method of any one of claims 25-27, wherein said chamber which provides said condition forms a part of the sensing system.

29. The method of any one of claims 23-28, wherein at least one fluid sample comprises a cell, the method being for determining a presence and/or an amount of said substance producing said oxidizing agent or said reducing agent in said cell.

30. The method of any one of claims 23-29, wherein said substance is a metabolite.

31. The method of claim 29, wherein at least one fluid sample comprises a cell, the method being for determining or monitoring metabolic activity of said cell.

32. The method of claim 31, wherein at least one fluid sample which comprises said cell further comprises a therapeutic agent, the method being for determining or monitoring activity of said cell upon contacting said therapeutic agent.

33. The method of claim 32, being for determining an efficacy of said therapeutic agent towards said cell.

34. The method of claim 29, wherein said substance is a metabolite, the method being for identifying an agent capable of altering a metabolic activity of the cell.

35. The method of any one of claims 23-31, wherein said fluid sample is a biological sample of a subject.

36. The method of claim 35, being for diagnosing a disease associated with a modified metabolic activity in a subject.

37. The method of claim 35, being for monitoring a treatment of a disease associated with a modified metabolic activity in a subject.

38. The system or method of any one of claims 1-37, wherein said redox reactive agent is a peroxide.