CLAIMS

1. A two-piece sensor assembly comprising:

an attachment collar configured to attach to a body surface of a patient and comprising at least one opening,

a skin sensor configured to seat into the at least one opening in the attachment collar and comprising:

at least one radiation source configured to irradiate the body surface with at least one interrogation light, and

at least one detector configured to detect at least one response light incident from the direction of the body surface;

wherein the two-piece sensor assembly is configured to exert a positive pressure on the body surface directly beneath the skin sensor, while simultaneously applying a negative pressure to the body surface beneath or surrounding the attachment collar.

2. The two-piece sensor assembly according to claim 1, wherein

the attachment collar forms a light-tight seal with the body surface, and

the skin sensor forms a light-tight seal with the attachment collar.

3. The two-piece sensor assembly according to claim 1, further comprising

a controller communicatively coupled to the skin sensor, the attachment collar or both,

wherein the controller is programed to transmit information and to receive information between the controller and the skin sensor and/or the attachment collar, and to control the at least one radiation source and the at least one detector.

4. The two-piece sensor assembly according to claim 3, wherein the controller is further programmed to receive authentication information from the skin sensor, the attachment collar or both.

5. The two-piece sensor assembly according to claim 1, wherein the attachment collar further comprises:

a locking mechanism configured to securely fasten the skin sensor to the at least one opening in the attachment collar.

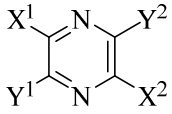
6. The two-piece sensor assembly according to claim 1, wherein the two-piece sensor assembly further comprises:

a cable management system configured to reduce or eliminate accidental cord pulls that would dislodge or detach the two-piece sensor assembly from the body of the patient and/or reduce or eliminate accidental cord pulls that would dislodge or detach the skin sensor from the attachment collar, and

said cable management system is attached to the attachment collar, the skin sensor or both.

7. The two-piece sensor assembly according to claim 1, wherein the at least one response light is generated by an optical response from an indicator substance inside the body of the patient in response to the interrogation light.

8. The two piece sensor assembly according to claim 7, wherein the indicator substances is a molecule according to Formula I,



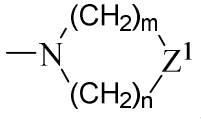
Formula I

or a pharmaceutically acceptable salt thereof;

wherein

each of X^1 and X^2 is independently selected from the group consisting of –CN, $–CO_2R^1$, $–CONR^1R^2$, –CO(AA), –CO(PS) and –CONH(PS);

each of Y^1 and Y^2 is independently selected from the group consisting of $–NR^1R^2$ and



;

Z^1 is a single bond, $–CR^1R^2–$, –O–, $–NR^1–$, $–NCOR^1–$, –S–, –SO–, or $–SO_2–$;

each of R^1 to R^2 are independently selected from the group consisting of H, –$CH_2(CHOH)_aH$, –$CH_2(CHOH)_aCH_3$, –$CH_2(CHOH)_aCO_2H$, –$(CHCO_2H)_aCO_2H$, –$(CH_2CH_2O)_cH$, –$(CH_2CH_2O)_cCH_3$, –$(CH_2)_aSO_3H$, –$(CH_2)_aSO_3^-$, –$(CH_2)_aSO_2H$, –$(CH_2)_aSO_2^-$, –$(CH_2)_aNHSO_3H$, –$(CH_2)_aNHSO_3^-$, –$(CH_2)_aNHSO_2H$, –$(CH_2)_aNHSO_2^-$,–$(CH_2)_aPO_4H_3$, –$(CH_2)_aPO_4H_2^-$, –$(CH_2)_aPO_4H^{2-}$, –$(CH_2)_aPO_4^{3-}$, –$(CH_2)_aPO_3H_2$, –$(CH_2)_aPO_3H^-$, and –$(CH_2)_aPO_3^{2-}$;

(AA) comprises one or more amino acids selected from the group consisting of natural and unnatural amino acids, linked together by peptide or amide bonds and each instance of (AA) may be the same or different than each other instance;

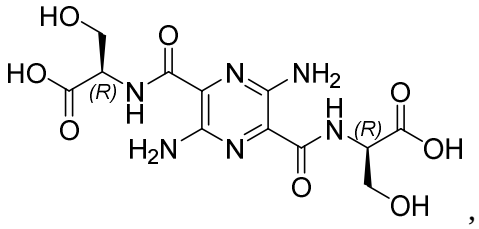
(PS) is a sulfated or non-sulfated polysaccharide chain that includes one or more monosaccharide units connected by glycosidic linkages;

‘a’ is a number from 0 to 10,

‘c’ is a number from 1 to 100, and

each of ‘m’ and ‘n’ are independently a number from 1 to 3.

9. The two piece sensor assembly according to claim 7, wherein the indicator substances is



,

or a pharmaceutically acceptable salt thereof.

10. The two-piece sensor assembly according to claim 9, wherein the detector is configured to measure an intensity of the response light at a plurality of time points.

11. The two-piece sensor assembly according to claim 1, wherein the attachment collar comprises an elastomer.

12. The two-piece sensor assembly according to claim 11, wherein the elastomer comprises a non-optically transmissive material.

13. The two-piece sensor assembly according to claim 12, wherein the non-optically transmissive material is graphite, carbon black, mylar, aluminum or a combination thereof.

14. The two-piece sensor assembly according to claim 3, wherein the controller and the skin sensor are communicatively coupled using a cable connection, a wireless connection, or both.

15. The two-piece sensor assembly according to claim 1, wherein the attachment collar further comprises:

a means for securing the skin sensor to the at least one opening of the attachment collar.

16. The two-piece sensor assembly according to claim 1, wherein the two-piece sensor assembly further comprises:

a means for managing a cable attached thereto, and

the means for managing the cable is attached to the attachment collar, the skin sensor or both.

17. The two-piece sensor assembly according to claim 1, wherein the skin sensor and the attachment collar further comprises:

a means of authentication between the skin sensor and the attachment collar.

18. The two-piece sensor assembly according to claim 1, further comprises a two-sided adhesive; and

wherein the two-sided adhesive is configured to adhere to the skin of the patient on a first side and adhere to the skin sensor on a second side.

19. The two-piece sensor assembly according to claim 18, wherein the two-sided adhesive is a pressure activated adhesive that exhibits a stronger adhesive strength when placed under pressure as compared to the adhesive strength when not under pressure.

20. A method for determining a glomerular filtration rate (GFR) in a patient in need thereof, the method comprising:

applying the two-piece sensor assembly of claim 1 onto the body surface of the patient,

administering into the body of the patient an indicator substance, said indicator substance configured to generate an optical response in response to an interrogation light;

detecting said optical response using the two-piece sensor assembly over a predetermined period of time; and

determining the GFR in said patient based on the detected optical response.