CLAIMS

1. An apparatus for predicting a parameter in the blood stream of a subject comprising

a laser diode source arranged to emit light of at least two different wavelengths;

a first optical receiver arranged to receive incident light of the at least two different wavelengths where the subject is not present;

a second optical receiver arranged to receive transmitted light of the at least two different wavelengths when a desired part of the subject is present; and

a processor for calculating the ratio of the intensity of the received transmitted or diffuse reflected light to incident light for each of the at least two different wavelengths to provide an indication of the parameter in the blood stream of the subject, wherein the parameter to be predicted is the level of glycosylated hemoglobin (HbA1c) and

wherein the indication of the parameter in the blood stream of the subject is calculated according to the following formula where there are exactly two wavelength present:

$$R = \frac{-\alpha_{1Hb}\ln(\frac{I_2}{I_{02}}) + \alpha_{2Hb}\ln(\frac{I_1}{I_{01}})}{\ln(\frac{I_1}{I_{01}})(\alpha_{2Hb} - \alpha_{2HbA1c}) - \ln(\frac{I_2}{I_{02}})(\alpha_{1Hb} - \alpha_{1HbA1c})}$$

where α_{1HbA1c}, α_{2HbA1c}, α_{1Hb} and α_{2Hb} are the extinction coefficient of HbA1c and the extinction coefficient of ordinary hemoglobin (Hb) at the two selected wavelengths subscripted 1 and 2 respectively; and

$\frac{I_1}{I_{01}}, \frac{I_2}{I_{02}}$ are the ratios of the intensity of the received transmitted or diffuse reflected light to incident light for each of the two different wavelengths

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2. The apparatus according to claim 1, wherein the at least two different light wavelengths are infra-red wavelengths selected by identifying an absorption peak and an absorption trough on a Fourier Transform infra-red (FTIR) spectrum obtained in response of the infra-red wavelengths to the parameter.

~~3. The apparatus according to claim 1, wherein the parameter to be predicted is the level of glycosylated hemoglobin (HbA1c).~~

~~4. The apparatus according to claim 3, wherein the indication of the parameter in the blood stream of the subject is calculated according to the following formula where there are exactly two wavelength present:~~

$$R = \frac{-\alpha_{1Hb}\ln(\frac{I_2}{I_{02}}) + \alpha_{2Hb}\ln(\frac{I_1}{I_{01}})}{\ln(\frac{I_1}{I_{01}})(\alpha_{2Hb} - \alpha_{2HbA1c}) - \ln(\frac{I_2}{I_{02}})(\alpha_{1Hb} - \alpha_{1HbA1c})}$$

~~where α_{1HbA1c}, α_{2HbA1c}, α_{1Hb} and α_{2Hb} are the extinction coefficient of HbA1c and the extinction coefficient of ordinary hemoglobin (Hb) at the two selected wavelengths subscripted 1 and 2 respectively; and~~

~~$\frac{I_1}{I_{01}}, \frac{I_2}{I_{02}}$ are the ratios of the intensity of the received transmitted or diffuse reflected light to incident light for each of the two different wavelengths.~~

~~5~~3. The apparatus according to claim 1, wherein one of the at least two different wavelengths is between 1650 to 1660 nanometers and another of the at least two different wavelength is between 1680 to 1700 nanometers.

~~6~~4. The apparatus according to claim 1, wherein the first optical receiver comprises an optical lens pair and the second optical receiver comprises an optical probe.

~~7. An optical probe for use in an apparatus for predicting a parameter in the blood stream of a subject according to claim 5, the optical probe comprising an input fiber~~

~~and a plurality of collection fibers; wherein the distance between each of the plurality of collection fibers and the input fiber is between 0.5 millimeters to 2 millimeters.~~

~~8. The optical probe according to claim 7 wherein the optical probe is disc shaped with the input fiber at the centre and the collection fibers disposed in the circumference of the optical probe.~~

~~9~~5. A method for predicting a parameter in the blood stream of a subject comprising the following steps:

a. emitting at least two different light wavelengths from a laser diode source;

b. receiving incident light of the at least two different light wavelength from a first optical receiver where the subject is not present;

c. receiving transmitted or diffuse reflected light of the at least two different light wavelength from a second optical receiver when a desired part of the subject is present;

d. calculating the ratio of the intensity of the received transmitted or diffuse reflected light to incident light for each of the at least two different wavelengths to provide an indication of the parameter in the blood stream of the subject,

wherein the parameter to be predicted is the level of glycosylated hemoglobin (HbA1c) and

wherein the indication of the parameter in the blood stream is calculated according to the following formula where there are exactly two wavelengths present:

$$R = \frac{-\alpha_{1Hb}\ln(\frac{I_2}{I_{02}}) + \alpha_{2Hb}\ln(\frac{I_1}{I_{01}})}{\ln(\frac{I_1}{I_{01}})(\alpha_{2Hb} - \alpha_{2HbA1c}) - \ln(\frac{I_2}{I_{02}})(\alpha_{1Hb} - \alpha_{1HbA1c})}$$

where α_{1HbA1c}, α_{2HbA1c}, α_{1Hb} and α_{2Hb} are the extinction coefficient of HbA1c and the extinction coefficient of ordinary hemoglobin (Hb) at the two selected wavelengths subscripted 1 and 2 respectively; and

$\frac{I_1}{I_{01}}, \frac{I_2}{I_{02}}$ are the ratios the intensity of the received transmitted or diffuse reflected light to incident light for each of the two different wavelengths.

~~10~~6. The method according to claim ~~9~~5, wherein the at least two different light wavelengths are infra-red wavelengths selected by identifying an absorption peak and an absorption trough on a Fourier Transform infra-red (FTIR) spectrum obtained in response of the infra-red wavelengths to the parameter.

~~11. The method according to claim 9, wherein the parameter to be predicted is the level of glycosylated hemoglobin (HbA1c).~~

~~12. The method according to claim 11, wherein the indication of the parameter in the blood stream is calculated according to the following formula where there are exactly two wavelengths present:~~

$$R = \frac{-\alpha_{1Hb}\ln(\frac{I_2}{I_{02}}) + \alpha_{2Hb}\ln(\frac{I_1}{I_{01}})}{\ln(\frac{I_1}{I_{01}})(\alpha_{2Hb} - \alpha_{2HbA1c}) - \ln(\frac{I_2}{I_{02}})(\alpha_{1Hb} - \alpha_{1HbA1c})}$$

~~where α_{1HbA1c}, α_{2HbA1c}, α_{1Hb} and α_{2Hb} are the extinction coefficient of HbA1c and the extinction coefficient of ordinary hemoglobin (Hb) at the two selected wavelengths subscripted 1 and 2 respectively; and~~

~~$\frac{I_1}{I_{01}}, \frac{I_2}{I_{02}}$ are the ratios the intensity of the received transmitted or diffuse reflected light to incident light for each of the two different wavelengths.~~

~~137~~. The method according to claim ~~95~~, wherein one of the at least two different wavelengths is between 1650 to 1660 nanometers and another one of the at least two different wavelength is between 1680 to 1700 nanometers.

~~148~~. The method according to claim ~~95~~, wherein the first optical receiver comprises an optical lens pair and the second optical receiver comprises an optical probe.

~~159~~. A kit for predicting a parameter in the blood stream of a subject comprising one or more of the apparatus according to claims 1 to ~~54~~; and a set of instructions for using the apparatus according to claims ~~8-5~~ to ~~148~~.

CLAIMS

1. An apparatus for predicting a parameter in the blood stream of a subject comprising

a laser diode source arranged to emit light of at least two different wavelengths;

a first optical receiver arranged to receive incident light of the at least two different wavelengths where the subject is not present;

a second optical receiver arranged to receive transmitted light of the at least two different wavelengths when a desired part of the subject is present; and

a processor for calculating the ratio of the intensity of the received transmitted or diffuse reflected light to incident light for each of the at least two different wavelengths to provide an indication of the parameter in the blood stream of the subject, wherein the parameter to be predicted is the level of glycosylated hemoglobin (HbA1c) and

wherein the indication of the parameter in the blood stream of the subject is calculated according to the following formula where there are exactly two wavelength present:

$$R = \frac{-\alpha_{1Hb}\ln(\frac{I_2}{I_{02}}) + \alpha_{2Hb}\ln(\frac{I_1}{I_{01}})}{\ln(\frac{I_1}{I_{01}})(\alpha_{2Hb} - \alpha_{2HbA1c}) - \ln(\frac{I_2}{I_{02}})(\alpha_{1Hb} - \alpha_{1HbA1c})}$$

where α_{1HbA1c}, α_{2HbA1c}, α_{1Hb} and α_{2Hb} are the extinction coefficient of HbA1c and the extinction coefficient of ordinary hemoglobin (Hb) at the two selected wavelengths subscripted 1 and 2 respectively; and

$\frac{I_1}{I_{01}}, \frac{I_2}{I_{02}}$ are the ratios of the intensity of the received transmitted or diffuse reflected light to incident light for each of the two different wavelengths

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2. The apparatus according to claim 1, wherein the at least two different light wavelengths are infra-red wavelengths selected by identifying an absorption peak and an absorption trough on a Fourier Transform infra-red (FTIR) spectrum obtained in response of the infra-red wavelengths to the parameter.

3. The apparatus according to claim 1, wherein one of the at least two different wavelengths is between 1650 to 1660 nanometers and another of the at least two different wavelength is between 1680 to 1700 nanometers.

4. The apparatus according to claim 1, wherein the first optical receiver comprises an optical lens pair and the second optical receiver comprises an optical probe.

5. A method for predicting a parameter in the blood stream of a subject comprising the following steps:

a. emitting at least two different light wavelengths from a laser diode source;

b. receiving incident light of the at least two different light wavelength from a first optical receiver where the subject is not present;

c. receiving transmitted or diffuse reflected light of the at least two different light wavelength from a second optical receiver when a desired part of the subject is present;

d. calculating the ratio of the intensity of the received transmitted or diffuse reflected light to incident light for each of the at least two different wavelengths to provide an indication of the parameter in the blood stream of the subject,

wherein the parameter to be predicted is the level of glycosylated hemoglobin (HbA1c) and

wherein the indication of the parameter in the blood stream is calculated according to the following formula where there are exactly two wavelengths present:

$$R = \frac{-\alpha_{1Hb}\ln(\frac{I_2}{I_{02}}) + \alpha_{2Hb}\ln(\frac{I_1}{I_{01}})}{\ln(\frac{I_1}{I_{01}})(\alpha_{2Hb} - \alpha_{2HbA1c}) - \ln(\frac{I_2}{I_{02}})(\alpha_{1Hb} - \alpha_{1HbA1c})}$$

where α_{1HbA1c}, α_{2HbA1c}, α_{1Hb} and α_{2Hb} are the extinction coefficient of HbA1c and the extinction coefficient of ordinary hemoglobin (Hb) at the two selected wavelengths subscripted 1 and 2 respectively; and

$\frac{I_1}{I_{01}}, \frac{I_2}{I_{02}}$ are the ratios the intensity of the received transmitted or diffuse reflected light to incident light for each of the two different wavelengths.

6. The method according to claim 5, wherein the at least two different light wavelengths are infra-red wavelengths selected by identifying an absorption peak and an absorption trough on a Fourier Transform infra-red (FTIR) spectrum obtained in response of the infra-red wavelengths to the parameter.

7. The method according to claim 5, wherein one of the at least two different wavelengths is between 1650 to 1660 nanometers and another one of the at least two different wavelength is between 1680 to 1700 nanometers.

8. The method according to claim 5, wherein the first optical receiver comprises an optical lens pair and the second optical receiver comprises an optical probe.

9. A kit for predicting a parameter in the blood stream of a subject comprising one or more of the apparatus according to claims 1 to 4; and a set of instructions for using the apparatus according to claims 5 to 8.