

CLAIMS**WHAT IS CLAIMED IS:**

1. A method of detecting presence or absence of endometriosis in a female subject, comprising:
 - (a) detecting in a bodily fluid sample from the female subject an expression profile of a panel of miRNAs associated with endometriosis, wherein the panel of miRNAs associated with endometriosis comprises miR-342 or miR451a;
 - (b) applying a machine learning algorithm to the expression profile of the panel of miRNAs associated with endometriosis, wherein the machine learning algorithm has importance measures assigned to miRNA features, and wherein:
 - i. an importance measure is assigned to miR-342 and the importance measure assigned to miR-342 is greater than the importance measure assigned to at least one miRNA selected from the group consisting of: miR-150, miR-3613, miR-451a, let-7b, and miR-125b; or
 - ii. an importance measure is assigned to miR-451a and the importance measure assigned to miR-451a is greater than the importance measure assigned to at least one miRNA selected from the group consisting of: miR-3613, miR-125b, and let-7b; and
 - (c) using the machine learning algorithm to detect presence or absence of endometriosis in the female subject.
2. The method of claim 1, wherein the female subject has symptoms of endometriosis.
3. The method of claim 1, wherein the female subject has symptoms of endometriosis selected from the group consisting of: abdominal pain, gastrointestinal upset, excessive bleeding, infertility and menstrual disturbance.
4. The method of any one of the preceding claims, wherein the subject has not been previously diagnosed with endometriosis.
5. The method of any one of the preceding claims, wherein the subject has been previously diagnosed with endometriosis and the method confirms presence of endometriosis in the female subject.
6. The method of any one of the preceding claims, further comprising diagnosing endometriosis in the female subject when the presence of endometriosis is detected.
7. The method of any one of the preceding claims, further comprising prognosing or monitoring endometriosis in the female subject when the presence of endometriosis is detected.

8. The method of any one of the preceding claims, further comprising administering a treatment for endometriosis to the female subject when the presence of endometriosis is detected.
9. The method of any one of the preceding claims, further comprising determining that the female subject has a condition that is not endometriosis when the absence of endometriosis is detected.
10. The method of any one of the preceding claims, further comprising administering a treatment for a non-endometriosis condition to the female subject when the absence of endometriosis is detected.
11. The method of any one of the preceding claims, wherein the importance measure assigned to miR-342 is greater than the importance measure assigned to at least one miRNA selected from the group consisting of: miR-150, miR-3613, miR-451a, let-7b, and miR-125b.
12. The method of claim 11, wherein the importance measure assigned to miR-342 is less than the importance measure assigned to at least one other miRNA.
13. The method of any one of the preceding claims, wherein the importance measure assigned to miR-342 is greater than the importance measure assigned to at least two miRNA selected from the group consisting of: miR-150, miR-3613, miR-451a, let-7b, or miR-125b.
14. The method of any one of the preceding claims, wherein the importance measure assigned to miR-342 is greater than the importance measure assigned to at least three miRNA selected from the group consisting of: miR-150, miR-3613, miR-451a, let-7b, or miR-125b.
15. The method of any one of the preceding claims, wherein the importance measure assigned to miR-342 is greater than the importance measure assigned to at least four miRNA selected from the group consisting of: miR-150, miR-3613, miR-451a, let-7b, and miR-125b.
16. The method of any one of the preceding claims, wherein the importance measure assigned to miR-342 is greater than the importance measure assigned to miR-150, miR-3613, miR-451a, let-7b, and miR-125b.
17. The method of claim 1, wherein the importance measure assigned to miR-451a is greater than the importance measure assigned to at least one miRNA selected from the group consisting of: miR-3613, miR-125b and let-7b.
18. The method of claim 1, wherein the importance measure assigned to miR-451a is greater than the importance measure assigned to at least two miRNA selected from the group consisting of: miR-3613, miR-125b and let-7b.
19. The method of claim 1, wherein the importance measure assigned to miR-451a is greater than the importance measure assigned to miR-3613, miR-125b and let-7b.

20. The method of any one of the preceding claims, wherein the importance measures are assigned such that the ranking of the importance measures from highest to lowest is: miR-342, miR-451a, miR-3613, miR-125b, let-7b, and miR-150.
21. The method of any one of the preceding claims, wherein the bodily fluid sample comprises cells.
22. The method of any one of the preceding claims, wherein the bodily fluid sample is a cell-free sample.
23. The method of any one of the preceding claims, wherein the bodily fluid sample is a blood sample, a plasma sample, a saliva sample, or a serum sample.
24. The method of any one of the preceding claims, wherein the panel of miRNA are cell-free miRNA
25. The method of any one of the preceding claims, wherein the panel of miRNA are cell-associated miRNA or exosome-associated miRNA.
26. The method of any one of the preceding claims, wherein the applying a machine learning algorithm to the expression profile comprises applying a machine learning algorithm with specific importance measure rankings assigned to the miRNA features, wherein the ranking from highest to lowest is miR-342, miR-451a, miR-3613, miR-125b, let-7b, and miR-150.
27. The method of any one of the preceding claims, wherein the machine learning algorithm is a random forest algorithm, k-nearest-neighbors algorithm (KNN), support vector machine (SVM), or Naive Bayes.
28. The method of any one of the preceding claims, wherein the machine learning algorithm is a random forest algorithm.
29. The method of any one of the preceding claims, wherein the method detects endometriosis in a population of women with a specificity of greater than 80%.
30. The method of claim 29, wherein the population of women is premenopausal women.
31. The method of claim 29, wherein the population of women comprises women with leiomyomas, cystadenomas, chronic pelvic infections, teratomas, endometriomas, or paratubal cysts.
32. The method of claim 29, wherein the population of women comprises women with Stage I/II endometriosis.
33. The method of claim 29, wherein the population of women comprises women with Stage III/IV endometriosis or women with all four stages of endometriosis (Stage I/II/III/IV).
34. The method of claim 29, wherein the population of women comprises women having received hormone therapy within 3 months of the date on which the sample was obtained or women at any phase of their menstrual cycle.

35. The method of claim 29, wherein the population of women comprises a cohort comprising at least 100 women, at least 500 women, or at least 1000 women.
36. The method of any one of the preceding claims, wherein the machine learning algorithm is trained on expression data from at least 100 samples, at least 500 samples, or at least 1000 samples.
37. The method of any one of the preceding claims, wherein the machine learning algorithm is trained on a population of women comprising women having stages I-IV endometriosis.
38. The method of any one of the previous claims, wherein the method has an AUC for detecting endometriosis of greater than 0.85 in a population of women, greater than 0.90 in a population of women, or greater than 0.92 in a population of women.
39. The method of any one of the preceding claims, wherein the method detects endometriosis in a population of women with a specificity of greater than 85%, greater than 90%, or greater than 95%.
40. The method of any one of the preceding claims, wherein the method detects endometriosis in a population of women with a sensitivity of greater than 80%, a sensitivity greater than 85%, or a sensitivity greater than 90%.
41. The method of any one of the preceding claims, wherein the method detects endometriosis in a population of women with a specificity of greater than 90% and a sensitivity of less than 85%.
42. The method of any one of the preceding claims, wherein the method detects endometriosis in a population of women with a sensitivity of less than 90%, less than 85%, or less than 80%.
43. The method of any one of the preceding claims, further comprising treating the female subject with a treatment that does not involve surgery when the absence of endometriosis is detected.
44. The method of any one of the preceding claims, further comprising administering a treatment to the female subject when the presence of endometriosis is detected, wherein the treatment comprises a hormonal treatment, surgery, laparoscopic surgery, a statin, a non-steroidal anti-inflammatory drug (NSAID), an oral contraceptive, a progestin, a gonadotrophin releasing (GnRH) agonist, a GnRH antagonist, an androgen, an antiprogestone, a selective estrogen receptor modulator (SERM), a selective progesterone receptor modulator (SPRM), atorvastatin, cerivastatin, fluvastatin, lovastatin, mevastatin, pitavastatin, pravastatin, rosuvastatin, simvastatin, paracetamol, a COX-2 inhibitor, or aspirin.

45. The method of any one of the preceding claims, wherein the miRNA expression level is detected by quantitative real-time polymerase chain reaction (RT-PCR), microarray, sequencing, or Next Generation sequencing.
46. A method of classifying endometriosis in a female subject comprising:
- (a) obtaining a bodily fluid sample comprising miRNA wherein the bodily fluid sample is from a female subject;
 - (b) performing quantitative real-time polymerase chain reaction, microarray assay or sequencing assay on a set of miRNA within the bodily fluid sample, wherein the set of miRNA comprises two or more different miRNA associated with endometriosis;
 - (c) comparing to an amount of a control RNA, an amount of the two or more different miRNA associated with endometriosis in the biological sample to determine a normalized miRNA level for the two or more different miRNAs in the bodily fluid sample;
 - (d) classifying the female subject as positive or negative for endometriosis by inputting the normalized miRNA levels to a trained algorithm, wherein the trained algorithm weighs importance rankings of the two or more different miRNA and wherein the trained algorithm is optimized for a specificity that is higher than sensitivity by selecting an optimal cutoff point on a receiver operating characteristic (ROC) curve or on a voting percentage distribution for the two or more different miRNA associated with endometriosis; and
 - (e) outputting a report on a computer screen that identifies the female subject as either positive or negative for endometriosis based on the classifying of the female subject as positive or negative for endometriosis in (d).
47. The method of claim 46, wherein the trained algorithm is optimized to detect endometriosis with a specificity of greater than 80% in a population of women.
48. The method of claim 46, wherein the trained algorithm is optimized to detect endometriosis with a specificity of greater than 90% and a sensitivity less than 85% in a population of women.
49. The method of claim 46, wherein the trained algorithm detects Stage I/II endometriosis with a specificity of greater than 90%, or greater than 95% in a population of women.
50. The method of any one of the preceding claims, wherein the method has an AUC for detecting endometriosis of greater than 0.85 in a population of women.
51. The method of any one of the preceding claims, wherein the method has an AUC for detecting endometriosis of greater than 0.9 in a population of women.
52. The method of any one of the preceding claims, wherein the method has an AUC for detecting endometriosis of greater than 0.92 in a population of women.

53. The method of any one of the preceding claims, wherein the method detects endometriosis in a population of women with a specificity of greater than 85%.
54. The method of any one of the preceding claims, wherein the method detects endometriosis in a population of women with a specificity of greater than 90%.
55. The method of any one of the previous claims, wherein the method detects endometriosis in a population of women with a specificity of greater than 95%.
56. The method of any one of the preceding claims, wherein the method detects endometriosis in a population of women with a sensitivity of greater than 80%.
57. The method of any one of the preceding claims, wherein the method detects endometriosis in a population of women with a sensitivity of greater than 90%.
58. The method of any one of the preceding claims, wherein the method detects endometriosis in a population of women with a sensitivity of less than 90%, less than 85%, or less than 80%.
59. The method of any one of the preceding claims, wherein the population of women comprises at least 100 women.
60. The method of claim 59, wherein the population of at least 100 women comprises women with leiomyomas.
61. The method of any one of the preceding claims, wherein the method has an area under curve (AUC) value greater than 0.85 irrespective of endometriosis stage or hormonal treatment.
62. The method of claim 46, further comprising administering a treatment for endometriosis to the female subject after the report identifies the female subject as being negative for endometriosis.
63. The method of claim 46, further comprising administering a treatment for a non-endometriosis condition to the female subject after the report identifies the female subject as being negative for endometriosis.
64. The method of any one of the preceding claims, further comprising repeating (a)-(e) on an additional bodily fluid sample obtained at least three months after the report identifies the female subject as being negative for endometriosis.
65. The method of any one of the preceding claims, wherein the trained algorithm assigns an importance measure to miR-342 that is greater than the importance measure assigned to at least one miRNA selected from the group consisting of: miR-150, miR-3613, miR-451a, let-7b, and miR-125b.
66. The method of any one of the preceding claims, wherein the importance measure assigned to miR-342 is less than the importance measure assigned to at least one other miRNA.

67. The method of any one of the previous claims, wherein the importance measure assigned to miR-342 is greater than the importance measure assigned to at least two miRNA selected from the group consisting of: miR-150, miR-3613, miR-451a, let-7b, or miR-125b.
68. The method of any one of the preceding claims, wherein the importance measure assigned to miR-342 is greater than the importance measure assigned to at least three miRNA selected from the group consisting of: miR-150, miR-3613, miR-451a, let-7b, or miR-125b.
69. The method of any one of the preceding claims, wherein the importance measure assigned to miR-342 is greater than the importance measure assigned to at least four miRNA selected from the group consisting of: miR-150, miR-3613, miR-451a, let-7b, and miR-125b.
70. The method of any one of the previous claims, wherein the importance measure assigned to miR-342 is greater than the importance measure assigned to miR-150, miR-3613, miR-451a, let-7b, and miR-125b.
71. The method of any one of the preceding claims, wherein the importance measure assigned to miR-451a is greater than the importance measure assigned to at least one miRNA selected from the group consisting of: miR-3613, miR-125b and let-7b.
72. The method of any one of the preceding claims, wherein the importance measure assigned to miR-451a is greater than the importance measure assigned to at least two miRNA selected from the group consisting of: miR-3613, miR-125b and let-7b.
73. The method of any one of the preceding claims, wherein the importance measure assigned to miR-451a is greater than the importance measure assigned to miR-3613, miR-125b and let-7b.
74. The method of any one of the preceding claims, wherein the importance measures are assigned such that the ranking of the importance measures from highest to lowest is: miR-342, miR-451a, miR-3613, miR-125b, let-7b, and miR-150.
75. The method of any one of the preceding claims, wherein the bodily fluid sample comprises cells.
76. The method of any one of the preceding claims, wherein the bodily fluid sample is a cell-free sample.
77. The method of any one of the previous claims, wherein the bodily fluid sample is a blood sample, a plasma sample, a saliva sample, or a serum sample.
78. The method of any one of the previous claims, wherein the applying a machine learning algorithm to the expression profile comprises applying a machine learning algorithm with specific importance measure rankings assigned to the miRNA features, wherein the ranking from highest to lowest is miR-342, miR-451a, miR-3613, miR-125b, let-7b, and miR-150.

79. The method of any one of the previous claims, wherein the machine learning algorithm is a random forest algorithm, k-nearest-neighbors algorithm (KNN), support vector machine (SVM), or Naive Bayes.
80. The method of any one of the preceding claims, wherein the machine learning algorithm is a random forest algorithm.
81. The method of any one of the preceding claims, wherein the population of women is premenopausal women.
82. The method of any one of the preceding claims, wherein the population of women comprises women with leiomyomas, cystadenomas, chronic pelvic infections, teratomas, endometriomas, or paratubal cysts, in any combination.
83. The method of any one of the preceding claims, wherein the population of women comprises women with Stage I/II endometriosis.
84. The method of any one of the preceding claims, wherein the population of women comprises women with Stage III/IV endometriosis or women with all four stages of endometriosis (Stage I/II/III/IV).
85. The method of any one of the preceding claims, wherein the population of women comprises women having received hormone therapy within 3 months of the date on which the sample was obtained or women at any phase of their menstrual cycle.
86. The method of any one of the preceding claims, wherein the population of women comprises a cohort comprising at least 100 women.
87. The method of any one of the preceding claims, wherein the population of women comprises a cohort comprising at least 500 women.
88. The method of any one of the preceding claims, wherein the population of women comprises a cohort comprising at least 1000 women.
89. The method of any one of the preceding claims, wherein the machine learning algorithm is trained on expression data from at least 100 samples.
90. The method of any one of the preceding claims, wherein the machine learning algorithm is trained on expression data from at least 1000 samples.
91. The method of any one of the preceding claims, wherein the machine learning algorithm is trained on a population of women comprising women having stages I-IV endometriosis.
92. The method of any one of the previous claims, further comprising treating the female subject with a treatment that does not involve surgery when the absence of endometriosis is detected.
93. The method of any one of the preceding claims, further comprising administering a treatment to the female subject when the presence of endometriosis is detected, wherein the

treatment comprises a hormonal treatment, surgery, laparoscopic surgery, a statin, a non-steroidal anti-inflammatory drug (NSAID), an oral contraceptive, a progestin, a gonadotrophin releasing (GnRH) agonist, a GnRH antagonist, an androgen, an antiprogestosterone, a selective estrogen receptor modulator (SERM), a selective progesterone receptor modulator (SPRM), atorvastatin, cerivastatin, fluvastatin, lovastatin, mevastatin, pitavastatin, pravastatin, rosuvastatin, simvastatin, paracetamol, a COX-2 inhibitor, or aspirin.

94. A method of diagnosing and treating endometriosis in a female subject, comprising:

(a) detecting in a saliva sample from the female subject an expression profile of a panel of miRNAs associated with endometriosis, wherein the panel of miRNAs associated with endometriosis comprises miR-125b and at least one other miRNA;

(b) applying a machine learning algorithm to the expression profile of the panel of miRNAs associated with endometriosis, wherein the machine learning algorithm has importance measures assigned to miRNA features, and wherein the importance measure of miR-125b is greater than the importance measure of miR-150, miR-3613, miR-451a, let-7b, or miR-342;

(c) using the machine learning algorithm to diagnose endometriosis in the female subject; and

(d) treating the endometriosis diagnosed in the female subject with a treatment for endometriosis.

95. The method of claim 94, wherein applying a machine learning algorithm to the expression profile comprises applying a machine learning algorithm with specific importance measures assigned to the miRNA features, wherein the importance measure of miR-125b is greater than at least one of miR-150, let-7b, miR-451a, or miR-3613.

96. The method of claim 94, wherein applying a machine learning algorithm to the expression profile comprises applying a machine learning algorithm with specific importance measures assigned to the miRNA features, wherein the importance measure of miR-125b is greater than at least two of miR-150, let-7b, miR-451a, or miR-3613.

97. The method of claim 94, wherein applying a machine learning algorithm to the expression profile comprises applying a machine learning algorithm with specific importance measures assigned to the miRNA features, wherein the importance measure of miR-125b is greater than at least three of miR-150, let-7b, miR-451a, or miR-3613.

98. The method of claim 94, wherein applying a machine learning algorithm to the expression profile comprises applying a machine learning algorithm with specific importance measures assigned to the miRNA features, wherein the importance measure of miR-125b is greater than miR-150, let-7b, miR-451a, and miR-3613.

99. A method of characterizing a female subject as having endometriosis comprising:

- (a) obtaining a bodily fluid sample comprising miRNA wherein the bodily fluid sample is from a female subject;
- (b) performing quantitative real-time polymerase chain reaction, microarray assay, or sequencing of a set of miRNA within the bodily fluid sample, wherein the set of miRNA comprises two or more different miRNA associated with endometriosis;
- (c) comparing to an amount in a control RNA, an amount of the two or more different miRNA associated with endometriosis in the biological sample to determine a normalized miRNA level for the two or more different miRNAs in the bodily fluid sample;
- (d) classifying the female subject as positive or negative for endometriosis by inputting the normalized miRNA levels to a trained algorithm, wherein the trained algorithm is optimized for a sensitivity of at least 80% by selecting an optimal cutoff point on a receiver operating characteristic (ROC) curve for the two or more different miRNA associated with endometriosis and wherein the trained algorithm weighs importance rankings of the two or more different miRNA; and
- (e) outputting a report on a computer screen that identifies the female subject as either positive or negative for endometriosis based on the classifying of the female subject as positive or negative for endometriosis in (d).

100. A method of characterizing a female subject as not having endometriosis comprising:

- (a) obtaining a bodily fluid sample comprising miRNA wherein the bodily fluid sample is from a female subject with abdominal pain, gastrointestinal upset, excessive bleeding, infertility or menstrual disturbance and said subject has not been previously diagnosed with endometriosis;
- (b) performing quantitative real-time polymerase chain reaction or sequencing of a set of miRNA within the bodily fluid sample, wherein the set of miRNA comprises two or more different miRNA associated with endometriosis;
- (c) comparing to an amount in a control RNA, an amount of the two or more different miRNA associated with endometriosis in the biological sample to determine a normalized miRNA level for the two or more different miRNAs in the bodily fluid sample;
- (d) classifying the female subject as positive or negative for endometriosis by inputting the normalized miRNA levels to a trained algorithm, wherein the trained algorithm is optimized for a specificity of at least 80% by selecting an optimal cutoff point on a receiver operating characteristic (ROC) curve for the two or more different miRNA associated with endometriosis and wherein the trained algorithm weighs importance rankings of the two or more different miRNA; and

(e) outputting a report on a computer screen that identifies the female subject as either positive or negative for endometriosis based on the classifying of the female subject as positive or negative for endometriosis in (d).

101. The method of claim 100, wherein the trained algorithm calculates a voting score indicative of likelihood of having endometriosis.

102. The method of claim 100, wherein the trained algorithm classifies the female subject as having endometriosis when the voting score is greater than 36%.

103. The method of claim 100, wherein the method has an area under curve (AUC) value greater than 0.85 for Stage I/II endometriosis.

104. The method of claim 100, wherein the method has an area under curve (AUC) value greater than 0.85 for distinguishing between endometriosis and leiomyomas.

105. The method of claim 100, wherein the method has an area under curve (AUC) value greater than 0.85 irrespective of endometriosis stage or hormonal treatment.

106. The method of claim 100, wherein the method is optimized for a specificity greater than 90% and a sensitivity less than 85%.

107. A method of detecting endometriosis in a female subject, comprising:

(a) detecting in a sample comprising miRNA from the subject an expression profile of a panel of miRNAs associated with endometriosis;

(b) applying a machine learning algorithm to the expression profile to detect endometriosis in the sample from the subject, wherein the machine learning algorithm is trained on a group of miRNA features selected from the group consisting of:

(i) miR-342, miR-451a, and miR-3613;

(ii) miR-342, miR-451a, miR-3613, and miR-125b;

(iii) miR-342, miR-451a, miR-3613, miR-125b, and let-7b;

(iv) miR-342, miR-451a, let-7b, and miR-125b;

(v) miR-342, miR-451a, let-7b, and miR-3613;

(vi) miR-342, miR-451a, and let-7b;

(vii) miR-125b, miR-150, miR-342, miR-451a, and let-7b; and

(viii) miR-125b, miR-150, miR-342, miR-3613, miR-451a, and let-7b.

108. The method of claim 107, further comprising obtaining the sample comprising miRNA from the subject, prior to (a).

109. The method of claim 107 or 108 wherein the sample is a saliva sample.

110. The method of claim 107 or 108, wherein the sample is a serum sample.

111. The method of any one of the preceding claims, wherein the machine learning algorithm is a random forest algorithm, k-nearest-neighbors algorithm (KNN), support vector machine (SVM), or Naive Bayes.
112. The method of any one of the preceding claims, wherein the method has an AUC for detecting endometriosis of greater than 0.85 in a population of women.
113. The method of claim 112, wherein the population of women is premenopausal women.
114. The method of claim 112, wherein the population of women is premenopausal and over 18.
115. The method of claim 112, wherein the population of women is premenopausal and under 49.
116. The method of any one of the preceding claims, wherein the population of women is negative for critical anemia, hyperplasia, polyps, and malignancy.
117. The method of claim 112, wherein the population of women includes women having received hormone therapy within 3 months of the date on which the sample was obtained.
118. The method of claim 117, wherein the hormone therapy includes birth control pills or GnRH agonists.
119. The method of any one of the preceding claims, wherein the machine learning algorithm is trained on expression data of at least 100 samples.
120. The method of any one of the preceding claims, wherein the machine learning algorithm is trained on a population of women with surgically-confirmed endometriosis.
121. The method of any one of the preceding claims, wherein the machine learning algorithm is trained on a population of women comprising women having stage I or II endometriosis.
122. The method of any one of the preceding claims, wherein the machine learning algorithm is trained on a population of women comprising women having stages I-IV endometriosis.
123. The method of any one of the preceding claims, wherein applying a machine learning algorithm to the expression profile comprises applying a machine learning algorithm with specific importance measures assigned to the miRNA features, wherein the importance measure of miR-342 is greater than at least one of miR-150, let-7b, or miR-125.
124. The method of any one of the preceding claims, wherein applying a machine learning algorithm to the expression profile comprises applying a machine learning algorithm with specific importance measures assigned to the miRNA features, wherein the importance measure of miR-125b is greater than one of miR-150, let-7b, miR-451a, or miR-3613.
125. The method of any one of the preceding claims, wherein applying a machine learning algorithm to the expression profile comprises training the machine learning algorithm on the group of miRNA features of (viii) and applying a machine learning algorithm with specific

importance measures assigned to the miRNA features, wherein the ranking of the miRNA features from highest to lowest is miR-125b, let-7b, miR-3613, miR-150, miR-342, and miR-451a.

126. The method of any one of the preceding claims, wherein applying a machine learning algorithm to the expression profile comprises training the machine learning algorithm on the group of miRNA features in (viii) and applying a machine learning algorithm with specific importance measure rankings assigned to the miRNA features, wherein the ranking from highest to lowest is miR-342, miR-451a, miR-3613, miR-125b, let-7b, and miR-150.

127. The method of any one of the preceding claims, wherein applying a machine learning algorithm to the expression profile comprises training the machine learning algorithm on the group of miRNA features in (viii) and applying an machine algorithm with specific importance measures assigned to the miRNA features, wherein the importance measure ranking of the miRNA features is according to any column in Table 9.

128. A method comprising:

(a) storing information related to the condition of a female patient in a standardized format in a plurality of network-based non-transitory storage devices;

(b) providing remote access to users over a network so that at least one user can update the information related to the condition of a female patient in real time through a graphical user interface, wherein the at least one user provides the updated information in the form of an expression profile of miRNAs from the female patient;

(c) converting, by a content server, the expression profile of the miRNAs from the female patient to a likelihood of the female patient having endometriosis using the application of a machine learning algorithm;

(d) storing the likelihood of the female patient having endometriosis;

(e) automatically generating a message containing the likelihood of the female patient having endometriosis by the content server whenever the updated information has been stored; and

(f) transmitting the message to all of the users over the computer network in real time, so that each user has immediate access to the likelihood of the female patient having endometriosis.

129. The method of claim 128, wherein the machine learning algorithm is trained on a group of miRNA features selected from the group consisting of:

(i) miR-342, miR-451a, and miR-3613;

(ii) miR-342, miR-451a, miR-3613, and miR-125b;

(iii) miR-342, miR-451a, miR-3613, miR-125b, and let-7b;

(iv) miR-342, miR-451a, let-7b, and miR-125b;

(v) miR-342, miR-451a, let-7b, and miR-3613;

- (vi) miR-342, miR-451a, and let-7b;
 - (vii) miR-125b, miR-150, miR-342, miR-451a, and let-7b; and
 - (viii) miR-125b, miR-150, miR-342, miR-3613, miR-451a, and let-7b.
130. The method of claim 128 or 129, further comprising obtaining a sample comprising miRNA from the subject.
131. The method of claim 130, wherein the sample is a blood sample, plasma sample, or erum sample.
132. The method of claim 130, wherein the sample is a saliva sample.
133. The method of claim 130, wherein the sample is a serum sample.
134. The method of any one of the preceding claims, wherein the machine learning algorithm is a random forest algorithm, k-nearest-neighbors algorithm (KNN), support vector machine (SVM), or Naive Bayes.
135. The method of any one of the preceding claims, wherein the method has an AUC for detecting endometriosis of greater than 0.85 in a population of women.
136. The method of any one of the preceding claims, wherein the population of women includes women having received hormone therapy within 3 months of the date on which the sample was obtained.
137. The method of any one of the preceding claims, wherein the hormone therapy includes birth control pills or GnRH agonists.
138. The method of any one of the preceding claims, wherein the sample is a cell-free serum sample.
139. The method of any one of the preceding claims, wherein the sample is a cell-free saliva sample.
140. The method of any one of the preceding claims, further comprising administering a treatment to the subject to treat the endometriosis based on the likelihood reported in (e).
141. The method of claim 140, wherein the treatment comprises a hormonal treatment, a statin, or a non-steroidal anti-inflammatory drug (NSAID).
142. The method of claim 140, wherein the hormonal treatment comprises an oral contraceptive, a progestin, a GnRH agonist, a GnRH antagonist, an androgen, an antiprogestosterone, a SERM, or SPRM.
143. The method of claim 140, wherein the statin comprises atorvastatin, cerivastatin, fluvastatin, lovastatin, mevastatin, pitavastatin, pravastatin, rosuvastatin, or simvastatin.
144. The method of claim 140, wherein the NSAID comprises paracetamol, a COX-2 inhibitor, or aspirin.

CLAIMS

WHAT IS CLAIMED IS:

1. A method of detecting presence or absence of endometriosis in a female subject, comprising:
 - (a) detecting in a bodily fluid sample from the female subject an expression profile of a panel of miRNAs associated with endometriosis, wherein the panel of miRNAs associated with endometriosis comprises miR-342 or miR451a;
 - (b) applying a machine learning algorithm to the expression profile of the panel of miRNAs associated with endometriosis, wherein the machine learning algorithm has importance measures assigned to miRNA features, and wherein:
 - i. an importance measure is assigned to miR-342 and the importance measure assigned to miR-342 is greater than the importance measure assigned to at least one miRNA selected from the group consisting of: miR-150, miR-3613, miR-451a, let-7b, and miR-125b; or
 - ii. an importance measure is assigned to miR-451a and the importance measure assigned to miR-451a is greater than the importance measure assigned to at least one miRNA selected from the group consisting of: miR-3613, miR-125b, and let-7b; and
 - (c) using the machine learning algorithm to detect presence or absence of endometriosis in the female subject.
2. The method of claim 1, wherein the female subject has symptoms of endometriosis.
3. The method of claim 1, wherein the female subject has symptoms of endometriosis selected from the group consisting of: abdominal pain, gastrointestinal upset, excessive bleeding, infertility and menstrual disturbance.
4. The method of any one of the preceding claims, wherein the subject has not been previously diagnosed with endometriosis.
5. The method of any one of the preceding claims, wherein the subject has been previously diagnosed with endometriosis and the method confirms presence of endometriosis in the female subject.
6. The method of any one of the preceding claims, further comprising diagnosing endometriosis in the female subject when the presence of endometriosis is detected.
7. The method of any one of the preceding claims, further comprising prognosing or monitoring endometriosis in the female subject when the presence of endometriosis is detected.
8. The method of any one of the preceding claims, wherein a treatment for endometriosis is to be administered to the female subject when the presence of endometriosis is detected.

9. The method of any one of the preceding claims, further comprising determining that the female subject has a condition that is not endometriosis when the absence of endometriosis is detected.
10. The method of any one of the preceding claims, wherein a treatment for a non-endometriosis condition is to be administered to the female subject when the absence of endometriosis is detected.
11. The method of any one of the preceding claims, wherein the importance measure assigned to miR-342 is greater than the importance measure assigned to at least one miRNA selected from the group consisting of: miR-150, miR-3613, miR-451a, let-7b, and miR-125b.
12. The method of claim 11, wherein the importance measure assigned to miR-342 is less than the importance measure assigned to at least one other miRNA.
13. The method of any one of the preceding claims, wherein the importance measure assigned to miR-342 is greater than the importance measure assigned to at least two miRNA selected from the group consisting of: miR-150, miR-3613, miR-451a, let-7b, or miR-125b.
14. The method of any one of the preceding claims, wherein the importance measure assigned to miR-342 is greater than the importance measure assigned to at least three miRNA selected from the group consisting of: miR-150, miR-3613, miR-451a, let-7b, or miR-125b.
15. The method of any one of the preceding claims, wherein the importance measure assigned to miR-342 is greater than the importance measure assigned to at least four miRNA selected from the group consisting of: miR-150, miR-3613, miR-451a, let-7b, and miR-125b.
16. The method of any one of the preceding claims, wherein the importance measure assigned to miR-342 is greater than the importance measure assigned to miR-150, miR-3613, miR-451a, let-7b, and miR-125b.
17. The method of claim 1, wherein the importance measure assigned to miR-451a is greater than the importance measure assigned to at least one miRNA selected from the group consisting of: miR-3613, miR-125b and let-7b.
18. The method of claim 1, wherein the importance measure assigned to miR-451a is greater than the importance measure assigned to at least two miRNA selected from the group consisting of: miR-3613, miR-125b and let-7b.
19. The method of claim 1, wherein the importance measure assigned to miR-451a is greater than the importance measure assigned to miR-3613, miR-125b and let-7b.
20. The method of any one of the preceding claims, wherein the importance measures are assigned such that the ranking of the importance measures from highest to lowest is: miR-342, miR-451a, miR-3613, miR-125b, let-7b, and miR-150.

21. The method of any one of the preceding claims, wherein the bodily fluid sample is a cell-free sample.
22. The method of any one of the preceding claims, wherein the bodily fluid sample is a blood sample, a plasma sample, a saliva sample, or a serum sample.
23. The method of any one of the preceding claims, wherein the panel of miRNA are cell-free miRNA
24. The method of any one of the preceding claims, wherein the applying a machine learning algorithm to the expression profile comprises applying a machine learning algorithm with specific importance measure rankings assigned to the miRNA features, wherein the ranking from highest to lowest is miR-342, miR-451a, miR-3613, miR-125b, let-7b, and miR-150.
25. The method of any one of the preceding claims, wherein the machine learning algorithm is a random forest algorithm, k-nearest-neighbors algorithm (KNN), support vector machine (SVM), or Naive Bayes.
26. The method of any one of the preceding claims, wherein the machine learning algorithm is a random forest algorithm.
27. The method of any one of the preceding claims, wherein the method detects endometriosis in a population of women with a specificity of greater than 80%.
28. The method of claim 27, wherein the population of women is premenopausal women.
29. The method of claim 27, wherein the population of women comprises women with leiomyomas, cystadenomas, chronic pelvic infections, teratomas, endometriomas, or paratubal cysts.
30. The method of claim 27, wherein the population of women comprises women with Stage I/II endometriosis.
31. The method of claim 27, wherein the population of women comprises women with Stage III/IV endometriosis or women with all four stages of endometriosis (Stage I/II/III/IV).
32. The method of claim 27, wherein the population of women comprises women having received hormone therapy within 3 months of the date on which the sample was obtained or women at any phase of their menstrual cycle.
33. The method of claim 27, wherein the population of women comprises a cohort comprising at least 100 women, at least 500 women, or at least 1000 women.
34. The method of any one of the preceding claims, wherein the machine learning algorithm is trained on expression data from at least 100 samples, at least 500 samples, or at least 1000 samples.
35. The method of any one of the preceding claims, wherein the machine learning algorithm is trained on a population of women comprising women having stages I-IV endometriosis.

36. The method of any one of the previous claims, wherein the method has an AUC for detecting endometriosis of greater than 0.85 in a population of women, greater than 0.90 in a population of women, or greater than 0.92 in a population of women.
37. The method of any one of the preceding claims, wherein the method detects endometriosis in a population of women with a specificity of greater than 85%, greater than 90%, or greater than 95%.
38. The method of any one of the preceding claims, wherein the method detects endometriosis in a population of women with a sensitivity of greater than 80%, a sensitivity greater than 85%, or a sensitivity greater than 90%.
39. The method of any one of the preceding claims, wherein the method detects endometriosis in a population of women with a specificity of greater than 90% and a sensitivity of less than 85%.
40. The method of any one of the preceding claims, wherein the method detects endometriosis in a population of women with a sensitivity of less than 90%, less than 85%, or less than 80%.
41. The method of any one of the preceding claims, wherein the miRNA expression level is detected by quantitative real-time polymerase chain reaction (RT-PCR), microarray, sequencing, or Next Generation sequencing.