

**CLAIMS**

What is claimed is:

1. An illumination system, comprising:
  - a surface configured to have an imaging target placed thereon;
  - a light source configured to emit a beam of light;
  - a beam splitter configured to split the beam of light from the light source into a first beam and a second beam;
  - a first mirror configured to reflect the first beam to provide a reflected first beam that illuminates the surface; and
  - a second mirror configured to reflect the second beam to provide a reflected second beam that illuminates the surface.
2. The illumination system of claim 1, wherein the reflected first beam and the reflected second beam provide off-axis illumination of the surface.
3. The illumination system of claim 1, wherein the reflected first beam and the reflected second beam provide substantially symmetrical illumination of the surface.
4. The illumination system of claim 1, wherein the beam of light has a beam of light optical power, the first beam has a first beam optical power and the second beam has a second beam optical power, and wherein the first beam optical power and the second beam optical power are each at least 40% of the beam of the light optical power.
5. The illumination system of claim 4, wherein the first beam optical power and the second beam optical power are each at least 45% of the beam of the light optical power.
6. The illumination system of claim 5, wherein the first beam optical power and the second beam optical power are substantially equal.

7. The illumination system of claim 1, further comprising a third mirror, wherein the reflected first beam or the reflected second beam is configured to reflect off of the third mirror prior to illuminating the surface.
8. The illumination system of claim 1, wherein the beam splitter is configured to split the beam of light from the light source into the first beam, the second beam, and a third beam.
9. The illumination system of claim 1, wherein the beam splitter comprises a prism, a plate, a dielectric mirror, a metal coated mirror, a beam splitter cube, a fiber optic beam splitter, or optical fibers configured to collimate light into a bundle before producing two or more output beams.
10. The illumination system of claim 1, wherein the first beam reflects off of the beam splitter, and wherein the second beam passes through the beam splitter.
11. The illumination system of claim 1, further comprising a second beam splitter configured to split the reflected first beam into two reflected beams that provide different degrees of off-axis illumination of the surface.
12. The illumination system of claim 11, further comprising a third beam splitter configured to split the reflected second beam into two reflected beams that provide different degrees of off-axis illumination of the surface.
13. The illumination system of claim 1, wherein an angle between a center of the first beam and a center of the second beam is from about 62° to about 68°.
14. The illumination system of claim 1, wherein an angle between a center of the reflected first beam and a center of the reflected second beam is from about 106° to about 114°.

15. The illumination system of claim 1, wherein a first distance from the beam splitter to the first mirror to the surface is substantially equal to a second distance from the beam splitter to the second mirror to the surface.
16. An illumination system, comprising:  
a surface configured to have an imaging target placed thereon;  
a light source configured to emit a beam of light;  
a beam splitter configured to split the beam of light from the light source into a first beam and a second beam, wherein the second beam illuminates the surface; and  
a first mirror configured to reflect the first beam from the beam splitter to provide a reflected first beam that illuminates the surface.
17. The illumination system of claim 16, wherein reflected first beam and the second beam provide substantially symmetrical illumination of the surface.
18. The illumination system of claim 16, wherein the beam splitter has a first end and a second end, and wherein the beam splitter is a variable beam splitter that splits optical power from the beam of light differently at the first end than at the second end.
19. The illumination system of claim 18, wherein the beam of light has a beam of light optical power, the first beam has a first beam optical power and the second beam has a second beam optical power, and wherein the first beam optical power and the second beam optical power are each at least 40% of the beam of the light optical power
20. The illumination system of claim 19, wherein the first beam optical power and the second beam optical power are each at least 45% of the beam of the light optical power.
21. The illumination system of claim 20, wherein the first beam optical power and the second beam optical power are substantially equal.
22. An illumination method, comprising:

providing a surface with an imaging target placed thereon;  
providing a beam of light with a light source;  
splitting the beam of light into a first beam and a second beam; and  
illuminating the surface, wherein illuminating comprises: (i) using a first mirror to reflect the first beam to produce a reflected first beam that illuminates the surface, and (ii) using a second mirror to reflect the second beam to produce a reflected second beam that illuminates the surface.

23. The method of claim 22, wherein the reflected first beam and the reflected second beam provide off-axis illumination of the surface.

24. The method of claim 22, wherein the reflected first beam and the reflected second beam provide substantially symmetrical illumination of the surface.

25. The method of claim 22, wherein the beam of light has a beam of light optical power, the first beam has a first beam optical power and the second beam has a second beam optical power, and wherein the first beam optical power and the second beam optical power are each at least 40% of the beam of the light optical power.

26. The method of claim 25, wherein the first beam optical power and the second beam optical power are each at least 45% of the beam of the light optical power.

27. The method of claim 26, wherein the first beam optical power and the second beam optical power are substantially equal.

28. The method of claim 22, wherein a third mirror is used to reflect the reflected first beam or the reflected second beam prior to illuminating the surface.

29. The method of claim 22, wherein the beam of light is split into the first beam, the second beam, and a third beam.

30. The method of claim 22, wherein the beam of light is split by a beam splitter.
31. The method of claim 30, wherein the beam splitter comprises a prism, a plate, a dielectric mirror, a metal coated mirror, a beam splitter cube, a fiber optic beam splitter, or optical fibers configured to collimate light into a bundle before producing two or more output beams.
32. The method of claim 30, wherein the first beam reflects off of the beam splitter, and wherein the second beam passes through the beam splitter.
33. The method of claim 22, wherein the reflected first beam is split into two reflected beams that provide different degrees of off-axis illumination of the surface.
34. The method of claim 33, wherein the reflected second beam is split into two reflected beams that provide different degrees of off-axis illumination of the surface.
35. The method of claim 22, wherein an angle between a center of the first beam and a center of the second beam is from about  $62^{\circ}$  to about  $68^{\circ}$ .
36. The method of claim 22, wherein an angle between a center of the reflected first beam and a center of the reflected second beam is from about  $106^{\circ}$  to about  $114^{\circ}$ .
37. The method of claim 30, wherein a first distance from the beam splitter to the first mirror to the surface is substantially equal to a second distance from the beam splitter to the second mirror to the surface.
38. An illumination method, comprising:  
providing a beam of light with a light source;  
splitting the beam of light into a first beam and a second beam; and  
illuminating a surface with an imaging target placed thereon, wherein illuminating comprises using a first mirror to reflect the first beam to produce a reflected first beam that

illuminates the surface, and wherein the second beam is split from the beam of light such that it illuminates the surface.

39. An imaging system, comprising:  
an imaging surface configured to have an imaging target placed thereon;  
a mirror; and  
a capturing device configured to capture an image of the imaging target through a path of emitted light that extends from the imaging target, reflects off of the mirror, and to the capturing device, wherein the mirror, the capturing device, or both are configured to move in a diagonal direction with respect to the imaging surface to reduce a length of the path of emitted light.
40. The imaging system of claim 39, wherein the mirror moves in the diagonal direction, and wherein a reflective surface of the mirror remains oriented diagonally with respect to the imaging surface as the mirror moves.
41. The imaging system of claim 39, wherein the capturing device and the mirror both move in different diagonal directions simultaneously.
42. The imaging system of claim 39, wherein the path of emitted light reflects off of an area on the mirror, and wherein the area decreases when the capturing device, the mirror, or both move in the diagonal direction with respect to the imaging surface to reduce the length of the path of emitted light.
43. The imaging system of claim 39, wherein a center of the path of emitted light reflects off of a point on the mirror, and wherein the point moves when the capturing device, the mirror, or both move in the diagonal direction with respect to the imaging surface to reduce the length of the path of emitted light.
44. The imaging system of claim 39, further comprising:  
a mirror shaft, wherein the mirror is configured to move in a first diagonal direction along the mirror shaft; and

a capturing device shaft, wherein the capturing device is configured to move in a second diagonal direction along the capturing device shaft.

45. The imaging system of claim 39, further comprising a transmission block that transmits movement between the mirror and the capturing device, thereby causing the mirror and the capturing device to move simultaneously.

46. The imaging system of claim 45, further comprising:  
a first transmission shaft extending between the capturing device and the transmission block, wherein the capturing device, the transmission block, or both are configured to move along the first transmission shaft; and  
a second transmission shaft extending between the mirror and the transmission block, wherein the mirror, the transmission block, or both are configured to move along the second transmission shaft.

47. The imaging system of claim 39, further comprising:  
a motor; and  
a drive screw coupled to the motor, wherein the motor is configured to rotate the drive screw, and wherein the capturing device, the mirror, or both move in the diagonal direction in response to rotation of the drive screw.

48. The imaging system of claim 39, further comprising:  
a first motor configured to cause the mirror to move in a first diagonal direction; and  
a second motor configured to cause the capturing device to move in a second diagonal direction, wherein the mirror and the capturing device move simultaneously, and wherein the mirror and the capturing device move at a fixed rate with respect to one another.

49. The imaging system of claim 39, further comprising a light source configured to emit a beam of light below the capturing device, wherein a lower end of the mirror is positioned above a lower end of the capturing device, even when the length of the path of emitted light is minimized, so that the lower end of the mirror does not obstruct the beam of light.

50. The imaging system of claim 39, wherein the capturing device is configured to capture the image of the imaging target without digital magnification or a zoom lens.

51. An imaging system, comprising:

an imaging surface configured to have an imaging target placed thereon;

a mirror;

a mirror shaft, wherein the mirror is configured to move in a first diagonal direction along the mirror shaft;

a capturing device configured to capture an image of the imaging target through a path of emitted light that extends from the imaging target, reflects off of the mirror, and to the capturing device;

a capturing device shaft, wherein the capturing device is configured to move in a second diagonal direction along the capturing device shaft; and

a transmission block that transmits movement between the mirror and the capturing device, thereby causing the mirror and the capturing device to move simultaneously.

52. The imaging system of claim 51, further comprising:

a first transmission shaft extending between the capturing device and the transmission block, wherein the capturing device, the transmission block, or both are configured to move along the first transmission shaft; and

a second transmission shaft extending between the mirror and the transmission block, wherein the mirror, the transmission block, or both are configured to move along the second transmission shaft.

53. The imaging system of claim 53, further comprising:

a motor; and

a drive screw coupled to the motor, wherein the motor is configured to rotate the drive screw, and wherein the capturing device and the mirror move in response to rotation of the drive screw.

54. The imaging system of claim 53, wherein a center of the path of emitted light reflects off of a point on the mirror, and wherein the point moves when the capturing device and the mirror move respect to the imaging surface to reduce a length of the path of emitted light.
55. An imaging method, comprising:  
placing an imaging target on an imaging surface;  
causing a capturing device, a mirror, or both to move in a diagonal direction with respect to the imaging surface; and  
capturing an image of the imaging target, using the capturing device, through a path of emitted light that extends from the imaging target, reflects off of the mirror, and to the capturing device.
56. The method of claim 55, wherein a motor causes the capturing device, the mirror, or both to move to reduce a length of the path of emitted light.
57. The method of claim 56, further comprising transmitting movement between the capturing device and the mirror via a transmission block, thereby causing the capturing device and the mirror to move simultaneously in two different diagonal directions.
58. The method of claim 57, wherein a reflective surface of the mirror remains oriented diagonally with respect to the imaging surface as the mirror moves.
59. The method of claim 58, wherein a center of the path of emitted light reflects off of a point on the mirror, and wherein the point moves when the capturing device and the mirror move respect to the imaging surface to reduce a length of the path of emitted light.
60. The method of claim 57, wherein the capturing device captures the image of the imaging target without digital magnification or use of a zoom lens.
61. An illumination and imaging system, comprising:  
a surface configured to have an imaging target placed thereon;  
a light source configured to emit a beam of light;

a beam splitter configured to split the beam of light from the light source into a first beam and a second beam;

a first illumination mirror configured to reflect the first beam to provide a reflected first beam that illuminates the surface;

a second illumination mirror configured to reflect the second beam to provide a reflected second beam that illuminates the surface;

an emission mirror; and

a capturing device configured to capture an image of the imaging target through a path that extends from the imaging target, reflects off of the emission mirror, and to the capturing device, wherein the emission mirror, the capturing device, or both are configured to move in a diagonal direction with respect to the surface to reduce a length of the path.

62. The illumination and imaging system of claim 61, wherein the reflected first beam and the reflected second beam provide off-axis illumination of the surface.

63. The illumination and imaging system of claim 61, wherein the reflected first beam and the reflected second beam provide substantially symmetrical illumination of the surface.

64. The illumination and imaging system of claim 61, wherein the beam of light has a beam of light optical power, the first beam has a first beam optical power and the second beam has a second beam optical power, and wherein the first beam optical power and the second beam optical power are each at least 40% of the beam of the light optical power.

65. The illumination and imaging system of claim 64, wherein the first beam optical power and the second beam optical power are each at least 45% of the beam of the light optical power.

66. The illumination and imaging system of claim 65, wherein the first beam optical power and the second beam optical power are substantially equal.

67. The illumination and imaging system of claim 61, further comprising a third illumination mirror, wherein the reflected first beam or the reflected second beam is configured to reflect off of the third illumination mirror prior to illuminating the surface.
68. The illumination and imaging system of claim 61, wherein the beam splitter is configured to split the beam of light from the light source into the first beam, the second beam, and a third beam.
69. The illumination and imaging system of claim 61, wherein the beam splitter comprises a prism, a plate, a dielectric mirror, a metal coated mirror, a beam splitter cube, a fiber optic beam splitter, or optical fibers configured to collimate light into a bundle before producing two or more output beams.
70. The illumination and imaging system of claim 61, wherein the first beam reflects off of the beam splitter, and wherein the second beam passes through the beam splitter.
71. The illumination and imaging system of claim 61, further comprising a second beam splitter configured to split the reflected first beam into two reflected beams that provide different degrees of off-axis illumination of the surface.
72. The illumination and imaging system of claim 61, further comprising a third beam splitter configured to split the reflected second beam into two reflected beams that provide different degrees of off-axis illumination of the surface.
73. The illumination and imaging system of claim 61, wherein an angle between a center of the first beam and a center of the second beam is from about  $62^{\circ}$  to about  $68^{\circ}$ .
74. The illumination and imaging system of claim 61, wherein an angle between a center of the reflected first beam and a center of the reflected second beam is from about  $106^{\circ}$  to about  $114^{\circ}$ .

75. The illumination and imaging system of claim 61, wherein a first distance from the beam splitter to the first mirror to the surface is substantially equal to a second distance from the beam splitter to the second mirror to the surface.
76. The illumination and imaging system of claim 61, wherein the capturing device and the emission mirror both move in different diagonal directions simultaneously.
77. The illumination and imaging system of claim 61, wherein the capturing device comprises a lens, a filter, and a camera, and wherein the filter is positioned between the lens and the camera.
78. The illumination and imaging system of claim 61, wherein the path of emitted light reflects off of an area on the emission mirror, and wherein the area decreases when the capturing device, the emission mirror, or both move in the diagonal direction with respect to the imaging surface to reduce the length of the path of emitted light.
79. The illumination and imaging system of claim 61, wherein a center of the path of emitted light reflects off of a point on the emission mirror, and wherein the point moves when the capturing device, the emission mirror, or both move in the diagonal direction with respect to the imaging surface to reduce the length of the path of emitted light.
80. The illumination and imaging system of claim 61, further comprising:  
a mirror shaft, wherein the emission mirror is configured to move in a first diagonal direction along the mirror shaft; and  
a capturing device shaft, wherein the capturing device is configured to move in a second diagonal direction along the capturing device shaft.
81. The illumination and imaging system of claim 61, further comprising a transmission block that transmits movement between the emission mirror and the capturing device, thereby causing the emission mirror and the capturing device to move simultaneously.

82. The illumination and imaging system of claim 81, further comprising:  
a first transmission shaft extending between the capturing device and the transmission block, wherein the capturing device, the transmission block, or both are configured to move along the first transmission shaft; and  
a second transmission shaft extending between the emission mirror and the transmission block, wherein the emission mirror, the transmission block, or both are configured to move along the second transmission shaft.
83. The illumination and imaging system of claim 82, further comprising:  
a motor; and  
a drive screw coupled to the motor, wherein the motor is configured to rotate the drive screw, and wherein the capturing device, the mirror, or both move in the diagonal direction in response to rotation of the drive screw.
84. The illumination and imaging system of claim 61, further comprising:  
a first motor configured to cause the emission mirror to move in a first diagonal direction;  
and  
a second motor configured to cause the capturing device to move in a second diagonal direction, wherein the mirror and the capturing device move simultaneously, and wherein the mirror and the capturing device move at a fixed rate with respect to one another.
85. The illumination and imaging system of claim 61, further comprising a second light source configured to emit a beam of light from below the capturing device, wherein a lower end of the emission mirror is positioned above a lower end of the capturing device, even when the length of the path of emitted light is minimized, so that the lower end of the mirror does not obstruct the beam of light.
86. An illumination and imaging method, comprising:  
placing an imaging target on a surface;  
emitting a beam of light from a light source;  
splitting the beam of light into a first beam and a second beam;

illuminating the imaging target, wherein illuminating comprises: (i) using a first illumination mirror to reflect the first beam to produce a reflected first beam that illuminates the surface, and (ii) using a second illumination mirror to reflect the second beam to produce a reflected second beam that illuminates the surface; and capturing an image of the imaging target, using a capturing device, through a path that extends from the imaging target, reflects off of an emission mirror, and to the capturing device.

87. The method of claim 86, wherein the reflected first beam and the reflected second beam provide off-axis illumination of the surface.

88. The method of claim 86, wherein the reflected first beam and the reflected second beam provide substantially symmetrical illumination of the surface.

89. The method of claim 86, wherein the beam of light has a beam of light optical power, the first beam has a first beam optical power and the second beam has a second beam optical power, and wherein the first beam optical power and the second beam optical power are each at least 40% of the beam of the light optical power.

90. The method of claim 89, wherein the first beam optical power and the second beam optical power are each at least 45% of the beam of the light optical power.

91. The method of claim 90, wherein the first beam optical power and the second beam optical power are substantially equal.

92. The method of claim 86, wherein a third illumination mirror is used to reflect the reflected first beam or the reflected second beam prior to illuminating the surface.

93. The method of claim 86, wherein the beam of light is split into the first beam, the second beam, and a third beam.

94. The method of claim 86, wherein the beam of light is split is a beam splitter.

95. The method of claim 94, wherein the beam splitter comprises a prism, a plate, a dielectric mirror, a metal coated mirror, a beam splitter cube, a fiber optic beam splitter, or optical fibers configured to collimate light into a bundle before producing two or more output beams.
96. The method of claim 94, wherein the first beam reflects off of the beam splitter, and wherein the second beam passes through the beam splitter.
97. The method of claim 86, wherein the reflected first beam is split into two reflected beams that provide different degrees of off-axis illumination of the surface.
98. The method of claim 97, wherein the reflected second beam is split into two reflected beams that provide different degrees of off-axis illumination of the surface.
99. The method of claim 86, wherein an angle between a center of the first beam and a center of the second beam is from about 62° to about 68°.
100. The method of claim 87, wherein an angle between a center of the reflected first beam and a center of the reflected second beam is from about 106° to about 114°.
101. The method of claim 86, wherein a first distance from the beam splitter to the first illumination mirror to the surface is substantially equal to a second distance from the beam splitter to the second illumination mirror to the surface.
102. The method of claim 86, wherein a motor causes the capturing device, the emission mirror, or both to move to reduce a length of the path of emitted light.
103. The method of claim 102, further comprising transmitting movement between the capturing device and the mirror via a transmission block, thereby causing the capturing device and the mirror to move simultaneously in two different diagonal directions.

104. The method of claim 103, wherein a reflective surface of the mirror remains oriented diagonally with respect to the imaging surface as the mirror moves.

105. The method of claim 104, wherein a center of the path of emitted light reflects off of a point on the mirror, and wherein the point moves when the capturing device and the mirror move respect to the imaging surface to reduce a length of the path of emitted light.

106. A method for generating an image corrected for a non-uniformity, comprising:  
calculating a relative illumination of an imaging lens for a plurality of pixels on an imaging sensor;  
generating a flat fielding matrix based upon the relative illumination;  
capturing an image of one or more biological samples, wherein the image has a non-uniformity;  
and  
adjusting the captured image with the flat fielding matrix to generate an image corrected for the non-uniformity.

107. The method of claim 106, wherein generating a flat fielding matrix comprises inverting the relative illumination to generate a flat fielding matrix.

108. The method of claim 106, wherein adjusting the captured image with the flat fielding matrix comprises multiplying the captured image of the one or more biological samples by the value of the flat fielding matrix.

109. The method of claim 108, wherein adjusting further comprises multiplying the captured image of the one or more biological samples by the value of the flat fielding matrix on a pixel-to-pixel basis to generate a flat fielded image.

110. The method of claim 106, wherein the relative illumination is calculated using an equation obtained by a linear or a non-linear curve fitting regression.

111. The method of claim 110, wherein the curve can be a first degree polynomial, a second degree polynomial, or a third degree polynomial.
112. The method of claim 106, wherein the flat fielding matrix is a flat fielding master matrix.
113. The method of claim 106, wherein the flat fielded image displays a correct ratio of a signal level of each captured image of the one or more biological sample irrespective of its location on a field of view.
114. The method of claim 106, wherein the one or more biological sample comprises a biomolecule including a protein, a peptides, a glycoprotein, a modified protein, a nucleic acid, a DNA, a RNA, a carbohydrate, a lipid, a lipidoglycan, a biopolymers or a metabolite generated from cells and tissues.
115. The method of claim 114, wherein biomolecule is dispersed, located or embedded in a membrane, a gel, a filter paper, slide glass, microplate, or a matrix, such as a polyacrylamide gel or nitrocellulose or PDVF membrane blot, an agarose gel, an agar plate, a cell culture plate or a tissue section slide.
116. The method of claim 106, wherein the image is generated by a chemiluminescence change to the sample.
117. The method of claim 106, wherein the image is generated by a fluorescence change to the sample.
118. The method of claim 106, wherein the non-uniformity is displayed as images with signals of varying intensity for an identical signal measured at different locations on the field of view.
119. A method for generating an image corrected for a non-uniformity, comprising:  
capturing an image of one or more biological samples, wherein the image has a non-uniformity; and

adjusting the captured image with a flat fielding matrix to generate an image corrected for the non-uniformity.

120. The method of claim 119, wherein the flat fielding matrix is in the imaging system.

121. The method of claim 119, wherein adjusting the captured image comprises multiplying the captured image of the one or more biological samples by the value of the flat fielding matrix on a pixel-to-pixel basis to generate a flat fielded image.

122. A method for generating a flat fielding matrix for correcting images for a non-uniformity, comprising:

calculating a relative illumination of an imaging lens for a plurality of pixels on an imaging sensor; and

generating a flat fielding matrix based upon the relative illumination and normalization.

123. The method of claim 122, wherein the flat fielding matrix is in an imager.

124. The method of claim 123, wherein the flat fielding matrix is available to a user using the imager.

125. The method of claim 122, wherein generating the flat fielding matrix comprises inverting the relative illumination and normalization.