CLAIMS

What is claimed is:

1. A device for detecting an amyloid protein in an eye of a mammal, the device comprising:

a light source configured to emit light to illuminate the eye with at least one of a wavelength of light, a polarization of light or a combination thereof, each appropriate to produce fluorescence in at least an amyloid-binding compound when the amyloid-binding compound is bound to the amyloid protein, the amyloid-binding compound having been introduced to the eye and specifically binding to the amyloid protein indicative of the amyloidogenic disorder; and

an optical unit configured to receive light including fluorescence produced as a result of the illumination of the eye and to determine a time decay rate of fluorescence for at least the fluorescence produced by the amyloid-binding compound bound to the amyloid protein, the determining permitting distinguishing of the presence of the amyloid-binding compound bound to the amyloid protein in the eye based at least on the time decay rate.

2. A device according to Claim 1, wherein the optical unit is configured to determine the time decay rate for at least one of: a molecular rotor amyloid-binding compound; a Congo red or Congo red derivative amyloid-binding compound; a Chrysamine amyloid-binding compound; a Chrysamine derivative amyloid-binding compound; a Chrysamine G or Chyrsamine G derivative amyloid-binding compound; a Thioflavin T or Thioflavin T derivative amyloid-binding compound; and a Thioflavin S or Thioflavin S derivative amyloid-binding compound.

3. A device according to Claim 1 or 2, wherein the optical unit determines an intensity of fluorescence for at least the fluorescence produced by the amyloid-binding compound bound to the amyloid protein.

4. A device according to Claim 3, wherein the optical unit is configured to determine a quantity of the amyloid-binding compound bound to the amyloid protein, based on at least one of the intensity and the time decay rate.

5. A device according to any preceding claim, wherein the optical unit is configured to determine an average number of photons with a specific decay rate in a certain area of the eye.

6. A device according to any preceding claim, wherein the light source comprises a pulsed laser.

7. A device according to Claim 6, wherein the pulsed laser is configured to emit light at a repetition rate of between about 1 MHz and about 240 MHz.

8. A device according to Claim 6 or 7, wherein the pulsed laser is configured to emit light with pulse widths of between about 40 picoseconds to about 400 picoseconds wide.

9. A device according to any of Claims 6 through 8, wherein the pulsed laser is configured to emit light at a repetition rate of about 40 MHz and with a pulse width of about 200 picoseconds wide.

10. A device according to any preceding claim, further comprising an optical scanning unit configured to scan light from the light source over locations in the eye.

11. A device according to Claim 10, wherein the optical scanning unit comprises an objective lens mounted on a translation stage and a scanner comprising a galvanometric mirror.

12. A device according to Claim 10 or 11, wherein the optical scanning unit is arranged to sample at least one region of interest in the eye using

illumination by the light source, the sampling comprising illuminating at least one of a point or points, a plane or planes, or a volume or volumes within the at least one region and detecting the fluorescence emissions.

13. A device according to any of Claims 10 through 12, wherein the optical scanning unit is arranged to sample different locations across more than one region of the eye.

14. A device according to any of Claims 10 through 13, wherein the optical scanning unit is arranged to perform planar scans of the eye using the light source, in successive planes along a perpendicular axis extending depthwise into the eye.

15. A device according to any preceding claim, further comprising a photodetector unit for detecting fluorescence emitted from the eye.

16. A device according to Claim 15, wherein the photodetector unit comprises at least one of a photodiode, a photomultiplier, a charge-coupled device and an intensified charge-coupled device.

17. A device according to Claim 15, wherein the photodetector unit comprises an avalanche photodetector.

18. A device according to any one of Claims 15 through 17, further comprising a time correlation single photon count module receiving electrical signals from the photodetector unit indicative of photon counts of fluoresced light from the eye.

19. A device according to Claim 18, further comprising at least one processor module configured to determine the time decay rate of fluorescence based on a distribution of photon counts as a function of time channel units.

20. A device according to any preceding claim, wherein the optical unit is configured to distinguish the amyloid-binding compound bound to the amyloid protein from background autofluorescence of eye tissues, autofluorescence of other non-specific particles and unbound amyloid-binding compound.

21. A device according to any preceding claim, wherein the optical unit is configured to distinguish at least one of a presence or a quantity of more than one of the following: the amyloid-binding compound; the amyloid-binding compound bound to the amyloid protein; and the amyloid protein.

22. A device according to any preceding claim, wherein the amyloid protein comprises an aggregate.

23. A device according to any preceding claim, wherein the amyloid protein comprises a pre-amyloid protein aggregate.

24. A device according to any preceding claim, wherein the amyloid protein comprises beta-amyloid.

25. A device according to any preceding claim, wherein the amyloidogenic disorder comprises Alzheimer's disease.

26. A device according to any preceding claim, wherein the optical unit is configured to distinguish at least the presence of the amyloid protein based only on detected fluorescence.

27. A device according to any preceding claim, wherein the optical unit is configured to determine a rate of delivery of the amyloid-binding compound to the eye based on detected fluorescence.

28. A device according to any preceding claim, wherein the optical unit is configured to determine a spatial distribution of amyloid-binding compound delivered to the eye based on detected fluorescence.

29. A device according to any preceding claim, wherein the optical unit is configured to determine a gradient of concentration of the amyloid-binding compound at an interface of the cornea of the eye based on detected fluorescence.

30. A device according to any preceding claim, wherein the optical unit is configured to determine at least one of a spatial distribution of the amyloid-binding compound and a temporal distribution of the amyloid-binding compound in the aqueous humor of the eye based on detected fluorescence.

31. A device according to any preceding claim, wherein the optical unit is configured to determine a location of an ocular interface of the eye based on an increase in a fluorescent signal due to natural fluorescence emitted from tissues of the eye.

32. A device according to any preceding claim, wherein the optical unit is configured to determine a location of a supranucleus of the eye based on at least one of: (i) a distance away from an anatomical structure of the eye and (ii) a detection of a change in an intensity measurement.

33. A device according to any preceding claim, wherein the optical unit is configured to determine at least one dimension of an anatomical structure or substructure of the eye based on natural fluorescence excitation of at least a portion of the anatomical structure or substructure.

34. A device according to Claim 33, wherein determining the at least one dimension comprises at least one of determining a thickness of the structure or substructure, determining a shape of the structure or substructure, and

determining a distance between one or more structure or substructures of the eye.

35. A device according to any preceding claim, wherein the optical unit is configured to scan within the eye to determine excited natural fluorescence and thereby to determine at least one region of interest in the eye; and

to sample the at least one region of interest in the eye using illumination by the light source, the sampling comprising performing at least one of a measure of at least one entire region of the at least one region or a sampling of different locations within the at least one region using illumination by the light source, the sampling of different locations comprising illuminating at least one of a point, a plane or a volume within the at least one region;

the sampling being to determine an intensity of fluorescence and a time decay rate of fluorescence for at least the fluorescence produced by the amyloid-binding compound bound to the amyloid protein within the at least one sampled region.

36. A device according to any preceding claim, wherein the optical unit is configured to determine excited natural fluorescence along each point of an axial scan depthwise into the eye and thereby to determine at least one location of interest in the eye; and

wherein the optical unit is configured to determine an intensity of fluorescence and a time decay rate of fluorescence for at least the fluorescence produced by the amyloid-binding compound bound to the amyloid protein at each point of each of a set of planar scans of the eye using the light source, in successive planes perpendicular to the direction of the axial scan.

37. A device according to any preceding claim, the device being configured to enable a real time search within the eye for the amyloid protein indicative of the amyloidogenic disorder.

38. A device according to any preceding claim, wherein the light source is configured to emit light of an appropriate wavelength for a peak region of a fluorescent excitation spectrum for the amyloid-binding compound bound to the amyloid protein in the eye, and wherein the optical unit is configured to detect light of an appropriate wavelength for a peak region of a fluorescent emission spectrum for the amyloid-binding compound bound to the amyloid protein in the eye.

39. A device according to any preceding claim, wherein the amyloid-binding compound is Compound #11.

40. A device according to Claim 38 or Claim 39, wherein the excitation spectrum has a peak of about 470 nm, the light source being configured to emit light within plus or minus about 20 nm of the peak of the excitation spectrum, and wherein the emission spectrum has a peak of about 580 nm, and the optical unit being configured to detect light within plus or minus about 20 nm of the peak of the emission spectrum.

41. A device according to any preceding claim, wherein the amyloid protein is indicative of an amyloidogenic disorder.

42. A method for detecting an amyloid protein in an eye of a mammal, the method comprising:

illuminating the eye with a light source having at least one of a wavelength property, a polarization property or a combination thereof, each appropriate to produce fluorescence in at least an amyloid-binding compound when the amyloid-binding compound is bound to the amyloid protein, the amyloid-binding compound having been introduced to the eye and specifically binding to the amyloid protein indicative of the amyloidogenic disorder;

receiving light including fluorescence produced as a result of the illuminating the eye; and

determining a time decay rate of fluorescence for at least the fluorescence produced by the amyloid-binding compound bound to the amyloid protein, the determining permitting distinguishing of the presence of the amyloid-binding compound bound to the amyloid protein in the eye based on at least the time decay rate.

43. A method according to Claim 42, further comprising determining an intensity of fluorescence for at least the fluorescence produced by the amyloid-binding compound bound to the amyloid protein.

44. A method according to Claim 43, further comprising determining a quantity of the amyloid-binding compound bound to the amyloid protein, based on at least one of the intensity and the time decay rate.

45. A method according to any of Claims 42 through 44, wherein illuminating the eye with the light source comprises illuminating the eye with a pulsed laser.

46. A method according to any of Claims 42 through 45, comprising illuminating the eye with light at a repetition rate of between about 1 MHz and about 240 MHz.

47. A method according to any of Claims 42 through 46, comprising illuminating the eye with light comprising pulse widths of between about 40 picoseconds to about 400 picoseconds wide.

48. A method according to any of Claims 42 through 47, comprising illuminating the eye with light at a repetition rate of about 40 MHz and with a pulse width of about 200 picoseconds wide.

49. A method according to any of Claims 42 through 48, further comprising:

determining a location of an ocular interface of the eye based on an increase in a fluorescent signal due to natural fluorescence emitted from tissues of the eye.

50. A method according to any of Claims 42 through 49, further comprising:

sampling at least one region of interest in the eye using illumination by the light source, the sampling comprising illuminating at least one of a point or points, a plane or planes, or a volume or volumes within the at least one region and detecting the fluorescence emissions.

51. A method according to Claim 50, wherein the sampling comprises sampling different locations across more than one region of the eye.

52. A method according to any of Claims 42 through 51, further comprising:

performing planar scans of the eye using the light source, in successive planes along a perpendicular axis extending depthwise into the eye.

53. A method according to any of Claims 42 through 52, further comprising determining a location of a supranucleus of the eye based on at least one of: (i) a distance away from an anatomical structure of the eye and (ii) a detection of a change in an intensity measurement.

54. A method according to any of Claims 42 through 53, wherein the distinguishing the presence of the amyloid-binding compound bound to the amyloid protein comprises distinguishing the amyloid-binding compound bound to the amyloid protein from background autofluorescence of eye tissues, autofluorescence of other non-specific particles and unbound amyloid-binding compound.

55. A method according to any of Claims 42 through 54, further comprising distinguishing at least one of a presence and a quantity of more than one of the following: the amyloid-binding compound; the amyloid-binding compound bound to the amyloid protein; and the amyloid protein.

56. A method according to any of Claims 42 through 55, wherein the amyloid protein comprises an aggregate.

57. A method according to any of Claims 42 through 56, wherein the amyloid protein comprises a pre-amyloid protein aggregate.

58. A method according to any of Claims 42 through 57, wherein the amyloid protein comprises beta-amyloid.

59. A method according to any of Claims 42 through 58, wherein the amyloidogenic disorder comprises Alzheimer's disease.

60. A method according to any of Claims 42 through 59, wherein the amyloid-binding compound comprises a molecular rotor.

61. A method according to any of Claims 42 through 59, wherein the amyloid-binding compound comprises at least one of: a Congo red or Congo red derivative amyloid-binding compound; a Chrysamine amyloid-binding compound; a Chrysamine derivative amyloid-binding compound; a Chrysamine G or Chrysamine G derivative amyloid-binding compound; a Thioflavin T or Thioflavin T derivative amyloid-binding compound; and a Thioflavin S or Thioflavin S derivative amyloid-binding compound.

62. A method according to any of Claims 42 through 61, comprising distinguishing at least the presence of the amyloid protein based only on detected fluorescence.

63. A method according to any of Claims 42 through 62, further comprising determining a rate of delivery of the amyloid-binding compound to the eye based on detected fluorescence.

64. A method according to any of Claims 42 through 63, further comprising determining the average number of photons with a specific decay rate in a certain area of the eye.

65. A method according to any of Claims 42 through 64, further comprising determining a spatial distribution of amyloid-binding compound delivered to the eye based on detected fluorescence.

66. A method according to any of Claims 42 through 65, further comprising determining a gradient of concentration of the amyloid-binding compound at an interface of the cornea of the eye based on detected fluorescence.

67. A method according to any of Claims 42 through 66, further comprising determining at least one of a spatial distribution of the amyloid-binding compound and a temporal distribution of the amyloid-binding compound in the aqueous humor of the eye based on detected fluorescence.

68. A method according to any of Claims 42 through 67, further comprising determining at least one dimension of an anatomical structure or substructure of the eye based on natural fluorescence excitation of at least a portion of the anatomical structure or substructure.

69. A method according to Claim 68, wherein determining the at least one dimension comprises at least one of determining a thickness of the structure or substructure, determining a shape of the structure or substructure, and determining a distance between one or more structure or substructures of the eye.

70. A method according to any of Claims 42 through 69, further comprising detecting fluorescence produced by the eye using a photodetector device.

71. A method according to Claim 70, wherein the photodetector device comprises at least one of a photodiode, a photomultiplier, a charge-coupled device and an intensified charge-coupled device.

72. A method according to Claim 71, wherein the photodetector device comprises a fast avalanche photodiode detector.

73. A method according to any of Claims 42 through 72, further comprising performing a time correlation single photon counting of fluorescence produced by the eye.

74. A method according to Claim 73, wherein performing the time correlation single photon counting comprises pulsing the light source and determining the time decay rate of fluorescence based on a distribution of photon counts as a function of time channel units.

75. A method according to any of Claims 42 through 74, comprising:

scanning within the eye to determine excited natural fluorescence and thereby to determine at least one region of interest in the eye; and

sampling at least one region of interest in the eye using illumination by the light source, the sampling comprising illuminating at least one of a point or points, a plane or planes, or a volume or volumes within the at least one region;

the sampling being to determine an intensity of fluorescence and a time decay rate of fluorescence for at least the fluorescence produced by the amyloid-binding compound bound to the amyloid protein within the at least one sampled region.

76. A method according to any of Claims 42 through 75, comprising:

performing an axial scan depthwise into the eye to determine excited natural fluorescence along each point of the axial scan and thereby to determine at least one location of interest in the eye; and

performing planar scans of the eye using the light source, in successive planes perpendicular to the direction of the axial scan, to determine an intensity of fluorescence and a time decay rate of fluorescence for at least the fluorescence produced by the amyloid-binding compound bound to the amyloid protein at each point of each of the planar scans.

77. A method according to any of Claims 42 through 76, wherein the method enables a real time search within the eye for the amyloid protein indicative of the amyloidogenic disorder.

78. A method according to any of Claims 42 through 77, further comprising illuminating the eye with light of an appropriate wavelength for a peak region of a fluorescent excitation spectrum for the amyloid-binding compound bound to the amyloid protein in the eye; and

detecting light received from the eye of an appropriate wavelength for a peak region of a fluorescent emission spectrum for the amyloid-binding compound bound to the amyloid protein in the eye.

79. A method according to Claim 78, wherein the amyloid-binding compound is Compound #11.

80. A method according to Claim 78 or Claim 79, wherein the excitation spectrum has a peak of about 470 nm, the illuminating of the eye being at a wavelength within plus or minus about 20 nm of the peak of the excitation spectrum, and wherein the emission spectrum has a peak of about 580 nm, the detecting of light received from the eye being at a wavelength within plus or minus about 20 nm of the peak of the emission spectrum.

81. A method according to any of claims 42 through 80, wherein the amyloid protein is indicative of an amyloidogenic disorder.

82. A method for identifying an anatomical structure of an eye of a mammal, the method comprising:

illuminating the eye with a light source having at least one of a wavelength property, a polarization property or a combination thereof, each appropriate to produce natural fluorescence in the anatomical structure of the eye; and

determining a location within the eye of greatest change in intensity of the natural fluorescence produced by the illuminating with the light source, the determining permitting identifying of the anatomical structure based on the location of greatest change in intensity of the natural fluorescence.

83. A method according to Claim 82, wherein the anatomical structure comprises an anatomical structure of the anterior segment of the eye.

84. A method according to Claim 82 or 83, wherein the identifying of the anatomical structure comprises determining the location of an anatomical interface.

85. A method according to Claim 84, wherein the determining the location of the anatomical interface comprises determining the location of an interface of the lens capsule of the eye based on determining a location of the greatest increase in intensity of the natural fluorescence.

86. A method according to any of Claims 82 through 85, wherein the identifying of the anatomical structure comprises determining at least one of a corneal thickness, corneal shape, aqueous humor depth, lens shape, lens thickness, and at least one of a thickness and a shape of at least one substructure of the

lens of the eye based on natural fluorescence produced by the light source in the eye.

87. A method according to Claim 86, wherein the at least one substructure of the lens comprises at least one of a lens capsule, a cortex, a supranucleus and a nucleus of the eye.

88. A method according to any of Claims 82 through 87, wherein the identifying of the anatomical structure comprises determining an intra-ocular distance between at least two anatomical structures of the eye.

89. A method according to any of Claims 82 through 88, further comprising using the light source to detect in the eye of the mammal an amyloid protein indicative of an amyloidogenic disorder.

90. A method according to Claim 89, further comprising:

illuminating the eye of the mammal with the light source, the light source further comprising at least one of a wavelength property, a polarization property or a combination thereof, each appropriate to produce fluorescence in at least an amyloid-binding compound when the amyloid-binding compound is bound to the amyloid protein indicative of the amyloidogenic disorder, the amyloid-binding compound having been introduced to the eye and specifically binding to the amyloid protein indicative of the amyloidogenic disorder;

receiving light including fluorescence produced as a result of the illuminating the eye; and

determining a time decay rate of fluorescence for at least the fluorescence produced by the amyloid-binding compound bound to the amyloid protein, the determining permitting distinguishing of the presence of the amyloid-binding compound bound to the amyloid protein in the eye based on at least the time decay rate.

91. A method according to Claim 90, wherein the distinguishing the presence of the amyloid-binding compound bound to the amyloid protein comprises distinguishing the amyloid-binding compound bound to the amyloid protein from background autofluorescence of eye tissues, autofluorescence of other non-specific particles and unbound amyloid-binding compound.

92. A method according to any of Claims 82 through 91, wherein the method enables a real time search within the eye for the amyloid protein indicative of the amyloidogenic disorder.

93. A method according to any of Claims 82 through 92, further comprising illuminating the eye with light of an appropriate wavelength for a peak region of a fluorescent excitation spectrum for the amyloid-binding compound bound to the amyloid protein in the eye; and

detecting light received from the eye of an appropriate wavelength for a peak region of a fluorescent emission spectrum for the amyloid-binding compound bound to the amyloid protein in the eye.

94. A method according to Claim 93, wherein the amyloid-binding compound is Compound #11.

95. A method according to Claim 93 or Claim 94, wherein the excitation spectrum has a peak of about 470 nm, the illuminating of the eye being at a wavelength within plus or minus about 20 nm of the peak of the excitation spectrum, and wherein the emission spectrum has a peak of about 580 nm, the detecting of light received from the eye being at a wavelength within plus or minus about 20 nm of the peak of the emission spectrum.

96. A method according to any of Claims 42 through 81, wherein the method permits distinguishing between at least two different fluorophores with similar fluorescence spectra based on at least the time decay rate, the similar

fluorescence spectra comprising at least one of a significant overlap in emission spectra and excitation spectra.

97. A method according to any of Claims 42 through 81, further comprising representing a distribution of at least one of a fluorescent intensity and a lifetime decay of at least one fluorophore in two dimensions.

98. A method according to any of Claims 42 through 81, further comprising determining a number of photons bound and a number of photons unbound based on at least one of a fluorescent intensity and a lifetime decay of at least one fluorophore.

99. A method according to Claim 98, further comprising representing in two dimensions a distribution of fluorescent intensity and lifetime decay of bound amyloid-binding compound to protein and unbound amyloid-binding compound to protein.

100. A method according to Claim 99, further comprising synchronizing the representing in two dimensions with at least one of a scanner and a laser.

101. A method according to any of Claims 42 through 81, further comprising determining a parameter by averaging a fluorescent intensity, associated with a specific lifetime decay, over a specific area of the eye.

102. A method according to any of Claims 42 through 81, further comprising aligning an alignment light source with the eye along a confocal path to determine a reference point within the eye.

103. A method for determining bound fluorophores on a protein in an ocular tissue, the method comprising:

illuminating the ocular tissue with a light source having at least one of a wavelength property, a polarization property or a combination thereof,

each appropriate to produce fluorescence in at least an amyloid-binding compound when the amyloid-binding compound is bound to the protein, the amyloid-binding compound having been introduced to the ocular tissue and specifically binding to the protein;

receiving light including fluorescence produced as a result of the illuminating the eye; and

determining a time decay rate of fluorescence for at least the fluorescence produced by the amyloid-binding compound bound to the protein, the determining permitting distinguishing of the presence of the amyloid-binding compound bound to the protein in the ocular tissue based on at least the time decay rate.

CLAIMS

1. A device for detecting an amyloid protein in an eye of a mammal, the device comprising:

a light source configured to emit light to illuminate the eye with at least one of a wavelength of light, a polarization of light or a combination thereof, each appropriate to produce fluorescence in at least an amyloid-binding compound when the amyloid-binding compound is bound to the amyloid protein, the amyloid-binding compound having been introduced to the eye and specifically binding to the amyloid protein indicative of the amyloidogenic disorder; and

an optical unit configured to receive light including fluorescence produced as a result of the illumination of the eye and to determine a time decay rate of fluorescence for at least the fluorescence produced by the amyloid-binding compound bound to the amyloid protein, the determining permitting distinguishing of the presence of the amyloid-binding compound bound to the amyloid protein in the eye based at least on the time decay rate; and

the device comprising a photodetector unit for detecting fluorescence emitted from the eye and a time correlation single photon count module receiving electrical signals from the photodetector unit indicative of photon counts of fluoresced light from the eye.

2. A device according to Claim 1, wherein the optical unit is configured to determine the time decay rate for at least one of: a molecular rotor amyloid-binding compound; a Congo red or Congo red derivative amyloid-binding compound; a Chrysamine amyloid-binding compound; a Chrysamine derivative amyloid-binding compound; a Chrysamine G or Chyrsamine G derivative amyloid-binding compound; a Thioflavin T or Thioflavin T derivative amyloid-binding compound; and a Thioflavin S or Thioflavin S derivative amyloid-binding compound.

3. A device according to Claim 1 or Claim 2, wherein the optical unit determines an intensity of fluorescence for at least the fluorescence produced by the amyloid-binding compound bound to the amyloid protein.

4. A device according to Claim 3, wherein the optical unit is configured to determine a quantity of the amyloid-binding compound bound to the amyloid protein, based on at least one of the intensity and the time decay rate.

5. A device according to any one of Claims 1 to 4, wherein the optical unit is configured to determine an average number of photons with a specific decay rate in a certain area of the eye.

6. A device according to any one of Claims 1 to 5, wherein the light source comprises a pulsed laser.

7. A device according to Claim 6, wherein the pulsed laser is configured to emit light at a repetition rate of between about 1 MHz and about 240 MHz.

8. A device according to Claim 6 or Claim 7, wherein the pulsed laser is configured to emit light with pulse widths of between about 40 picoseconds to about 400 picoseconds wide.

9. A device according to any one of Claims 6 to 8, wherein the pulsed laser is configured to emit light at a repetition rate of about 40 MHz and with a pulse width of about 200 picoseconds wide.

10. A device according to any one of Claims 1 to 9, further comprising an optical scanning unit configured to scan light from the light source over locations in the eye.

11. A device according to Claim 10, wherein the optical scanning unit comprises an objective lens mounted on a translation stage and a scanner comprising a galvanometric mirror.

12. A device according to Claim 10 or Claim 11, wherein the optical scanning unit is arranged to sample at least one region of interest in the eye using illumination by the light source, the sampling comprising illuminating at least one of a point or points, a plane or planes, or a volume or volumes within the at least one region and detecting the fluorescence emissions.

13. A device according to any one of Claims 10 to 12, wherein the optical scanning unit is arranged to sample different locations across more than one region of the eye.

14. A device according to any one of Claims 10 to 13, wherein the optical scanning unit is arranged to perform planar scans of the eye using the light source, in successive planes along a perpendicular axis extending depthwise into the eye.

15. A device according to any one of Claims 1 through 14, wherein the photodetector unit comprises at least one of a photodiode, a photomultiplier, a charge-coupled device and an intensified charge-coupled device.

16. A device according to any one of Claims 1 through 14, wherein the photodetector unit comprises an avalanche photodetector.

17. A device according to Claim 15 or Claim 16, further comprising at least one processor module configured to determine the time decay rate of fluorescence based on a distribution of photon counts as a function of time channel units.

18. A device according to any one of Claims 1 to 17, wherein the optical unit is configured to distinguish the amyloid-binding compound bound to the amyloid protein from background autofluorescence of eye tissues, autofluorescence of other non-specific particles and unbound amyloid-binding compound.

19. A device according to any one of Claims 1 to 18, wherein the optical unit is configured to distinguish at least one of a presence or a quantity of more than one of the following: the amyloid-binding compound; the amyloid-binding compound bound to the amyloid protein; and the amyloid protein.

20. A device according to any one of Claims 1 to 19, wherein the amyloid protein comprises an aggregate.

21. A device according to any one of Claims 1 to 20, wherein the amyloid protein comprises a pre-amyloid protein aggregate.

22. A device according to any one of Claims 1 to 21, wherein the amyloid protein comprises beta-amyloid.

23. A device according to any one of Claims 1 to 22, wherein the amyloidogenic disorder comprises Alzheimer's disease.

24. A device according to any one of Claims 1 to 23, wherein the optical unit is configured to distinguish at least the presence of the amyloid protein based only on detected fluorescence.

25. A device according to any one of Claims 1 to 24, wherein the optical unit is configured to determine a rate of delivery of the amyloid-binding compound to the eye based on detected fluorescence.

26. A device according to any one of Claims 1 to 25, wherein the optical unit is configured to determine a spatial distribution of amyloid-binding compound delivered to the eye based on detected fluorescence.

27. A device according to any one of Claims 1 to 26, wherein the optical unit is configured to determine a gradient of concentration of the amyloid-binding compound at an interface of the cornea of the eye based on detected fluorescence.

28. A device according to any one of Claims 1 to 27, wherein the optical unit is configured to determine at least one of a spatial distribution of the amyloid-binding compound and a temporal distribution of the amyloid-binding compound in the aqueous humor of the eye based on detected fluorescence.

29. A device according to any one of Claims 1 to 28, wherein the optical unit is configured to determine a location of an ocular interface of the eye based on an increase in a fluorescent signal due to natural fluorescence emitted from tissues of the eye.

30. A device according to any one of Claims 1 to 29, wherein the optical unit is configured to determine a location of a supranucleus of the eye based on at least one of: (i) a

distance away from an anatomical structure of the eye and (ii) a detection of a change in an intensity measurement.

31. A device according to any one of Claims 1 to 30, wherein the optical unit is configured to determine at least one dimension of an anatomical structure or substructure of the eye based on natural fluorescence excitation of at least a portion of the anatomical structure or substructure.

32. A device according to Claim 31, wherein determining the at least one dimension comprises at least one of determining a thickness of the structure or substructure, determining a shape of the structure or substructure, and determining a distance between one or more structure or substructures of the eye.

33. A device according to any one of Claims 1 to 32, wherein the optical unit is configured to scan within the eye to determine excited natural fluorescence and thereby to determine at least one region of interest in the eye; and

to sample the at least one region of interest in the eye using illumination by the light source, the sampling comprising performing at least one of a measure of at least one entire region of the at least one region or a sampling of different locations within the at least one region using illumination by the light source, the sampling of different locations comprising illuminating at least one of a point, a plane or a volume within the at least one region;

the sampling being to determine an intensity of fluorescence and a time decay rate of fluorescence for at least the fluorescence produced by the amyloid-binding compound bound to the amyloid protein within the at least one sampled region.

34. A device according to any one of Claims 1 to 33, wherein the optical unit is configured to determine excited natural fluorescence along each point of an axial scan depthwise into the eye and thereby to determine at least one location of interest in the eye; and

wherein the optical unit is configured to determine an intensity of fluorescence and a time decay rate of fluorescence for at least the fluorescence produced by the amyloid-binding compound bound to the amyloid protein at each point of each of a set of planar scans of the eye using the light source, in successive planes perpendicular to the direction of the axial scan.

35. A device according to any one of Claims 1 to 34, the device being configured to enable a real time search within the eye for the amyloid protein indicative of the amyloidogenic disorder.

36. A device according to any one of Claims 1 to 35, wherein the light source is configured to emit light of an appropriate wavelength for a peak region of a fluorescent excitation spectrum for the amyloid-binding compound bound to the amyloid protein in the eye, and wherein the optical unit is configured to detect light of an appropriate wavelength for a peak region of a fluorescent emission spectrum for the amyloid-binding compound bound to the amyloid protein in the eye.

37. A device according to any one of Claims 1 to 36, wherein the amyloid-binding compound is Compound #11.

38. A device according to Claim 36 or Claim 37, wherein the excitation spectrum has a peak of about 470 nm, the light source being configured to emit light within plus or minus about 20 nm of the peak of the excitation spectrum, and wherein the emission spectrum has a peak of about 580 nm, and the optical unit being configured to detect light within plus or minus about 20 nm of the peak of the emission spectrum.

39. A device according to any one of Claims 1 to 38, wherein the amyloid protein is indicative of an amyloidogenic disorder.

40. A method for determining bound fluorophores on a protein in an ocular tissue, the method comprising:

illuminating the ocular tissue with a light source having at least one of a wavelength property, a polarization property or a combination thereof, each appropriate to produce fluorescence in at least an amyloid-binding compound when the amyloid-binding compound is bound to the protein, the amyloid-binding compound having been introduced to the ocular tissue and specifically binding to the protein;

receiving light including fluorescence produced as a result of the illuminating the eye; and

determining a time decay rate of fluorescence for at least the fluorescence produced by the amyloid-binding compound bound to the protein, the determining permitting distinguishing of the presence of the amyloid-binding compound bound to the protein in the ocular tissue based on at least the time decay rate;

wherein the method comprises performing a time correlation single photon counting of fluorescence produced by the ocular tissue.