MICROELECTRONIC ANIMAL IDENTIFICATION

CROSS-REFERENCES TO RELATED APPLICATIONS

[0001] The present application claims benefit of U.S. Provisional Patent Application No. 61/798,316, filed March 15, 2013, which application is incorporated herein by reference.

FIELD OF THE INVENTION

[0002] The present disclosure relates to systems and methods for providing microelectronic animal identification

BACKGROUND

[0003] Animals are marked for identification in a variety of applications by a variety of methods. The ability to accurately identify and track individual animals is necessary in research environments where animals are exposed to different experimental conditions, in the management of colonies of genetically modified animals for which multiple genotypes are present, and in breeding stocks where it is useful to track which animals possess certain desirable and undesirable traits.

SUMMARY OF DISCLOSURE

[0004] The present disclosure is directed to microelectronic animal identification. According to one aspect of the present disclosure, a microelectronic animal identification device comprises an inserter configured to releasably hold a microelectronic chip at a distal end of the inserter, and an actuator configured to release the microelectronic chip from the inserter when the distal end of the inserter is inserted into a substrate of an animal body part. ~~Optionally, t~~The animal is a mouse, a rat, or a rodent; ~~optionally,~~ the body part is a tail; and ~~optionally,~~ the substrate is dermis.

[0005] In some embodiments, the identification device further comprises a controller configured to control position of the inserter and to actuate the actuator to implant the microelectronic chip into the substrate of the animal body part.

[0006] In some embodiments, the the actuator is manually operated.

[0007] In some embodiments, the inserter terminates into a sharp tip capable of piercing into the substrate of the animal body parts.

[0008] In some embodiments, the inserter is configured to retain the microelectronic chip in proximity of the sharp tip.

[0009] In some embodiments, the inserter comprises a tubular body defining a lumen configures to securely retain the microelectronic chip at a distal end of the lumen.

[0010] In some embodiments, the lumen is dimensioned to limit the movement of microelectronic chip at the distal end of the lumen.

CLAIMS

What is claimed is:

1. A microelectronic animal identification device comprising an inserter configured to releasably hold a microelectronic chip at a distal end of the inserter, and an actuator configured to release the microelectronic chip from the inserter when the distal end of the inserter is inserted into a substrate of an animal body part, wherein

optionally, the animal is a mouse, a rat, or a rodent;

optionally, the body part is a tail; and

optionally, the substrate is dermis.

2. The identification device of claim 1, further comprising a controller configured to control position of the inserter and to actuate the actuator to implant the microelectronic chip into the substrate of the animal body part.

3. The identification device of claim 1, wherein the actuator is manually operated.

4. The identification device of claim 1, wherein the inserter terminates into a sharp tip capable of piercing into the substrate of the animal body part.

5. The identification device of claim 4, wherein the inserter is configured to retain the microelectronic chip in proximity of the sharp tip.

6. The identification device of claim 1, wherein the inserter comprises a tubular body defining a lumen configured to securely retain the microelectronic chip at a distal end of the lumen.

7. The identification device of claim 6, wherein the lumen is dimensioned to limit the movement of microelectronic chip at the distal end of the lumen.

8. The identification device of claim 7, wherein the lumen has a diameter that is slightly larger than a cross-sectional profile of the microelectronic chip.

9. The identification device of claim 7, wherein the distal end of the lumen is dimensioned to approximate the cross-sectional profile of the microelectronic chip

10. The identification device of claim 6, wherein the microelectronic chip is secured to the lumen with a biosafe adhesive.

11. The identification device of claim 6, wherein the tubular body terminates into a sharp tip extending distally beyond the microelectronic chip.

12. The identification device of claim 6, wherein the microelectronic chip includes a sharp end extending beyond a distal end of the tubular body.

13. The identification device of claim 6, wherein the actuator comprises a plunger slidably inserted into the lumen.

14. The identification device of claim 13, wherein the plunger is configured to engage and push the microelectronic chip out of the lumen when the distal end of the lumen is inserted into the substrate of the animal body part.

15. The identification device of claim 14, wherein the plunger is configured to disengage the microelectronic chip by a proximal movement of the plunger to limit rotation of the microelectronic chip in the substrate of the animal body part.

16. The identification device of claim 6, wherein the plunger is actuated by a controller.

17. The identification device of claim 6, wherein the plunger is manually actuated.

18. The identification device of claim 1, wherein the microelectronic chip comprises a photocell that provides power to the microelectronic chip.

19. The identification device of claim 18, wherein the microelectronic chip comprises an RF antenna capable of generating an RF signal that represents an identification number.

20. The identification device of claim 19, wherein the RF antenna comprises an antenna loop.

21. The identification device of claim 20, wherein the microelectronic chip further comprises an onboard logic circuitry capable of modulating current in the antenna loop to generate a different RF signal that represents a different identification number.

22. The identification device of claim 21, wherein the onboard logic circuitry is controlled by an electronic memory.

23. The identification device of claim 22, wherein the electronic memory is a ROM.

24. The identification device of claim 18, wherein the microelectronic chip further comprises an animal location detector.

25. The identification device of claim 18, wherein the microelectronic chip further comprises a laminated thin-film movement detector.

26. The identification device of claim 18, wherein the microelectronic chip further comprises a laminated thin-film vital sign detector.

27. The identification device of claim 26, wherein the vital sign detector is selected from the group consisting of heart rate detector, ECG detector, EEG detector, EMG detector, temperature detector, blood pressure detector, and combinations thereof.

28. The identification device of claim 19, wherein the microelectronic chip implant device is configured to implant the microelectronic chip beneath the epidermis of the animal body part at a depth that allows the RF signal to be detected.

29. The identification device of claim 19, wherein the microelectronic chip implant device is configured to implant the microelectronic chip beneath the epidermis of the animal body part at

a depth that allows the photocell to be activated, optionally by a laser that emits 5-60 mW of optical power at 660 nm.

30. The identification device of claim 1, further comprising a chip reading device for photo-activating the microelectronic chip and for receiving the RF signal generated by the RF antenna.

31. The identification device of claim 30, wherein the chip reading device comprises a laser diode driver for photo-activating the microelectronic chip.

32. The identification device of claim 30, wherein the chip reading device comprises an optical focusing module.

33. The identification device of claim 30, wherein the chip reading device comprises an air coil pickup connected to an RF receiver for receiving the RF signal generated by the microelectronic chip.

34. The identification device of claim 30, wherein the chip reading device comprises a field-programmable gate array (FGPA).

35. The identification device of claim 30, wherein the chip ready device comprises a USB microcontroller and power regulators.

36. An animal marking system comprising a microelectronic animal identification device of claims 1-35.

37. The marking system of claim 36, further comprising at least one restraining device operatively associated with the identification device, wherein the restraining device are sized and configured for restraining an animal or animal body part thereof and oriented such that the identification device can deposit a microelectronic chip into the substrate of the animal body part;

38. The marking system of claim 36, wherein the inserter is coupled to an inserter cartridge.

39. The marking system of claim 38, wherein the inserter cartridge comprises a reference feature configured to position the inserter cartridge on the identification device with precision.

40. The marking system of claim 39, wherein the reference feature comprises a locating cylinder extending between two end plates.

41. The marking system of claim 40, wherein the identification device comprises a docking member coupled to a scotch yoke, the docking member defining a receiving slot extending from a top surface to a bottom surface of the docking member.

42. The marking system of claim 41, wherein the locating cylinder of the reference feature is configured to be inserted into the receiving slot of the docking member.

43. The marking system of claim 42, wherein the two end plates of the reference feature respectively engage the top and bottom surfaces of the docking member when the locating cylinder of the reference feature is inserted into the receiving slot of the docking member.

44. The marking system of claim 40, wherein the locating cylinder comprises a center bore through which the inserter extends.

45. The marking system of claim 38, wherein the inserter cartridge comprises a locking feature configured to lock the inserter cartridge onto the identification device.

46. The marking system of claim 45, wherein the locking feature comprises a U-shaped flexible locking clip extending between two ends, each end of the locking clip comprises at least one outwardly extending locking teeth.

47. The marking system of claim 46, wherein the locking clip further comprises a plurality of gripping ribs on an exterior surface of the locking clip.

48. The marking system of claim 46, wherein the locking tooth are configured to abut an end wall of a scotch yoke of the microelectronic chip implant device when the inserter cartridge is in a mounted position.

49. The marking system of claim 38, wherein the inserter is coupled to the inserter cartridge by means of an adhesive.

50. The marking system of claim 38, wherein the inserter is coupled to the inserter cartridge by molding the inserter to the inserter cartridge.

51. The marking system of claim 50, wherein the inserter is molded from a polymer material.

52. The marking system of claim 38, wherein the inserter cartridge is permanently affixed to the identification device.

53. The marking system of claim 38, wherein the inserter cartridge is removable to allow replacement of worn or damaged inserters.

54. The marking system of any of claims 38, wherein the microelectronic chip implant device comprises multiple inserter cartridges dimensioned to account for differences in animal substrate size or geometry.

55. The marking system of claim 54, wherein the multiple inserter cartridges are pre-mounted onto the microelectronic chip implant device.

56. The marking system of claim 36, wherein the marking system is configured to automatically mount and dismount the inserter.

57. The marking system of claim 37, wherein the restraining device comprises a spring-loaded tapered v-groove configured to compensate for differences in size of the marking substrate.

58. The marking system of claim 57, wherein the spring-loaded tapered v-groove is modulated to compensate for differences in size of the substrate body part.

59. The marking system of any of claims 58, wherein the spring-loaded tapered v-groove is assembled in a support mount, and is optionally enclosed within a protective compliant boot.

60. The marking system of claim 58, wherein the modulated spring-loaded tapered v-groove comprises a plurality of independent groove sections, each groove section being articulating and self-aligning.

61. The marking system of any of claims 37, wherein the marking system is configured to select the inserter and the configuration of the restraining device based on the size of the marking substrate.

62. The marking system of claim 62, further comprising a measuring gauge configured to measure the size of the substrate of the animal body part, the measuring gauge comprising a plurality of measuring slots with incrementally increasing widths.

63. The marking system of claim 62, further comprising a measuring device configured to measure the size of the substrate of the animal body part by using a laser-generating device emitting a light curtain beam and a receiver that is incorporated into the measuring device.

64. The marking system of claim 46, further comprising a forked tool adapted to engage and compress the locking clip to facilitate removal of the inserter cartridge from the microelectronic chip implant device.

65. The marking system of claim 64, wherein the forked tool is integrated with a measuring gauge comprising a plurality of measuring slots with incrementally increasing widths.

66. The marking system of claim 36, further comprising a marking device for depositing a pigment composition into the substrate of the animal body parts.

67. The system of claim 66, wherein the marking device comprises a marking needle of fixed length comprising one or a plurality of needle tips;

68. The marking system of claim 67, wherein the needle tips are configured to penetrate the epidermis of the marking substrate and transfer a pigment into the dermis of the marking substrate.

69. The marking system of claim 66, further comprising a media transfer assembly containing the pigment, wherein the marking device is configured to make a mark by contacting the pigment prior to the marking substrate.

70. The identification device of claim 1, wherein the identification device is operated by a controller to deposit the microelectronic chip in a proximal to distal direction parallel to the animal tail.

71. The identification device of claim 1, wherein the microelectronic chip implant device is operated by the controller to implant the microelectronic chip in a distal to proximal direction parallel to the animal tail.

72. The identification device of claim 1, wherein the microelectronic chip implant device is operated by the controller to implant the microelectronic chip vertical to the animal tail.

73. A microelectronic chip for identification of an animal, the microelectronic chip comprises a photocell that provides power to the microelectronic chip, an RF antenna capable of generating an RF signal that represents an identification number, and a laminated thin-film detector.

74. The chip of claim 73, wherein the laminated thin-film detector is a location detector.

75. The chip of claim 73, wherein the laminated thin-film detector is a movement detector.

76. The chip of claim 73, wherein the laminated thin-film detector is a vital sign detector.

77. The identification device of claim 26, wherein the vital sign detector is selected from the group consisting of heart rate detector, ECG detector, EEG detector, EMG detector, temperature detector, blood pressure detector, and combinations thereof.

78. An animal identification system comprising:

a microelectronic chip implanted in a substrate of an animal, the microelectronic chip is photo-activated to generate an RF signal that represent a first identification number; and

a pigment mark imprinted in the substrate of an animal, the pigment mark representing a second identification number.

79. The identification system of claim 78, further comprising an tissue storage container for containing a sample tissue of the animal, wherein the tissue storage container comprises a second microelectronic chip configured to an RF signal that represent the first identification number.

80. The identification system of claim 79, wherein the sample tissue is taken when the microelectronic chip is implanted in the substrate of the animal.

81. The identification system of claim 78, further comprising a media transfer assembly containing the marking pigment, wherein the media transfer assembly comprises a third microelectronic chip configured to an RF signal that represent the first identification number.

82. The identification system of claim 78, further comprising a data management system for storing and cross-referencing the first, second and third identification numbers.

83. The identification device of claim 1, further comprising a chip reading device for activating the microelectronic chip and for receiving the RF signal generated by the RF antenna.

84. The identification device of claim 83, wherein the chip reading device comprises an air coil pickup connected to an RF receiver for receiving the RF signal generated by the microelectronic chip.

85. The identification device of claim 83, wherein the chip reading device comprises a field-programmable gate array (FGPA).

86. The identification device of claim 83, wherein the chip ready device comprises a USB microcontroller and power regulators.

87. An animal marking system comprising:

a microelectronic animal identification device,

a pigment tattooing identification device,

a media transfer assembly,

a restraining device,

a measuring device,

a chip reader,

a tissue sampling device, and

a data management system for storing and cross-referencing identification numbers.

CLAIMS

What is claimed is:

1. A microelectronic animal identification device comprising an inserter configured to releasably hold a microelectronic chip at a distal end of the inserter, and an actuator configured to release the microelectronic chip from the inserter when the distal end of the inserter is inserted into a substrate of an animal body part, wherein

the animal is a mouse, a rat, or a rodent;

the body part is a tail; and

the substrate is dermis.

2. The identification device of claim 1, further comprising a controller configured to control position of the inserter and to actuate the actuator to implant the microelectronic chip into the substrate of the animal body part.

3. The identification device of claim 1, wherein the actuator comprises a plunger slidably inserted into the lumen.

4. The identification device of claim 3, wherein the plunger is configured to engage and push the microelectronic chip out of the lumen when the distal end of the lumen is inserted into the substrate of the animal body part.

5. The identification device of claim 4, wherein the plunger is configured to disengage the microelectronic chip by a proximal movement of the plunger to limit rotation of the microelectronic chip in the substrate of the animal body part.

6. The identification device of claim 1, wherein the microelectronic chip comprises an RF antenna capable of generating an RF signal that represents an identification number.

7. The identification device of claim 6, wherein the microelectronic chip further comprises an animal location detector a laminated thin-film movement detector, or a laminated thin-film vital sign detector.

8. The identification device of claim 6, wherein the microelectronic chip implant device is configured to implant the microelectronic chip beneath the epidermis of the animal body part at a depth that allows the RF signal to be detected.

9. An animal marking system comprising a microelectronic animal identification device comprising an inserter configured to releasably hold a microelectronic chip at a distal end of the inserter, and an actuator configured to release the microelectronic chip from the inserter when the distal end of the inserter is inserted into a substrate of an animal body part, wherein

the animal is a mouse, a rat, or a rodent;

the body part is a tail;

the substrate is dermis;

at least one restraining device operatively associated with the identification device, wherein the restraining device are sized and configured for restraining an animal or animal body part thereof and oriented such that the identification device can deposit a microelectronic chip into the substrate of the animal body part.

10. The marking system of claim 9, wherein the inserter is coupled to an inserter cartridge.

11. The marking system of claim 9, wherein the marking system is configured to position the inserter and the restraining device is configured based on the size of the marking substrate.

12. The marking system of claim 11, further comprising a measuring device configured to measure the size of the substrate of the animal body part by using a laser-generating device emitting a light curtain beam and a receiver that is incorporated into the measuring device.

13. The marking system of claim 9, further comprising a marking device for depositing a pigment composition into the substrate of the animal body parts wherein the marking device optionally comprises a marking needle of fixed length comprising one or a plurality of needle tips, wherein the needle tips are optionally configured to penetrate the epidermis of the marking substrate and transfer a pigment into the dermis of the marking substrate.

14. The marking system of claim 13, further comprising a media transfer assembly containing the pigment, wherein the marking device is configured to make a mark by contacting the pigment prior to the marking substrate.