

## Claims

1. A method for cellular analysis by mass cytometry comprising:
  - providing a group of cells (18) labeled with more than one distinct elemental tag (Tn);
  - selecting a candidate cell (20) in the group of cells (18) by identifying the location of the candidate cell (20), the candidate cell (20) having a property of interest;
  - recording the location (22) of the candidate cell (20) according to its position within the group of cells (18);
  - directing at least one laser pulse (24) onto the candidate cell (20) at the recorded location (22) and generating a discrete plume (26) for each of the at least one laser pulse (24), each of the discrete plume (26) comprises the more than one distinct elemental tag (Tn);
  - introducing each of the discrete plume (26) into an inductively coupled plasma (14) and generating groups of elemental ions (28) corresponding with each of the more than one distinct elemental tag (Tn);
  - detecting each of the groups of elemental ions (28) simultaneously for each of the discrete plume (26) by mass cytometry; and
  - correlating the detected elemental ions (28) with the property of interest.
2. The method according to claim 1 in which providing the group of cells (18) labeled with more than one distinct elemental tag (Tn) comprises labeling the group of cells (18) with more than one elemental conjugated antibody, each of the more than one elemental conjugated antibody comprising one or more distinct elemental tag (Tn).
3. The method according to claim 2 in which the one or more distinct elemental tag (Tn) is selected from a group comprising transitional metals.
4. The method according to claim 3 in which correlating the detected elemental ions (28) with the property of interest comprises generating elemental tag data (30) from the detected elemental ions (24) and recording the elemental tag data against the property of interest.

5. The method according to claim 4 in which the group of cells (18) comprises more than one cell subgroup, each cell subgroup labeled with more than one distinct elemental tag (Tn).
6. The method according to claim 5 further comprising identifying the more than one cell subgroup according to the property of interest.
7. The method according to claim 6 in which the property of interest is identified by one or more of a fluorescence, a phosphorescence, a reflection, an absorption, a shape recognition, a physical feature, or a combination thereof.
8. The method according to claim 4 further comprising representing the location (22) of the candidate cell (20) in two-dimensional space within the group of cells (18).
9. The method according to claim 4 further comprising representing the location (22) of the candidate cell (20) in three-dimensional space within the group of cells (18).
10. The method according to claim 8 or 9 further comprising preparing the group of cells (18) with the property of interest.
11. The method according to claim 10 in which the property of interest is identified by one or more of a fluorescence, a phosphorescence, a reflection, an absorption, a shape recognition, a physical feature, or a combination thereof.
12. The method according to claim 10 in which the candidate cell (20) is identified by fluorescent emission.
13. The method according to claim 12 in which the group of cells (18) is a tissue sample.
14. A system for elemental tagged cell analysis comprising:
  - at least one interrogator (19) configured to identify the location (22) of a candidate cell (20);
  - a data source (21) having a format to record the location (22) of the candidate cell (20);
  - a laser ablation system (23) interfaced with the data source (21), the laser ablation system (23) configured to direct at least one laser pulse (24) at the location (22) of the candidate cell (20); and

a mass cytometer (16) coupled to the laser ablation system (23), the mass cytometer (16) configured to detect the elemental tag associated with the candidate cell (20).

15. The system according to claim 14 wherein the at least one interrogator (19) configured to identify the location (22) of the candidate cell having a property of interest and the data source (21) further formatted to record the property of interest.
16. The system according to claim 15 further comprising a control system (34) configured to interface the laser ablation system (23) with the data source (21).
17. The system according to claim 16 wherein the control system (34) configured to access the data source (21) and to direct the at least one laser pulse (24) at the location (22) of the candidate cell.
18. The system according to claim 15 wherein the at least one interrogator (19) is selected from an optical microscope, a fluorescence microscope, an electron microscope, a confocal microscope, and any combination thereof.
19. The system according to claim 14 wherein the data source (21) comprises a format selected from alphanumeric, emission image, barcode, radio frequency identification (RFID), and any combination thereof.
20. The system according to claim 14 wherein the mass cytometer comprises (16) an ion detector and a total path defined between the location of the candidate cell and the ion detector, the total path being configured to enable a combined delay time of between 20 and 200 msec.

## Claims

1. A method for cellular analysis by mass cytometry comprising:
  - providing a group of cells (18) labeled with more than one distinct elemental tag (Tn);
  - selecting a candidate cell (20) in the group of cells (18) by identifying the location of the candidate cell (20), the candidate cell (20) having a property of interest;
  - recording the location (22) of the candidate cell (20) according to its position within the group of cells (18);
  - directing at least one laser pulse (24) onto the candidate cell (20) at the recorded location (22) and generating a discrete plume (26) for each of the at least one laser pulse (24), each of the discrete plume (26) comprises the more than one distinct elemental tag (Tn);
  - introducing each of the discrete plume (26) into an inductively coupled plasma (14) and generating groups of elemental ions (28) corresponding with each of the more than one distinct elemental tag (Tn);
  - detecting each of the groups of elemental ions (28) simultaneously for each of the discrete plume (26) by mass cytometry; and
  - correlating the detected groups of elemental ions (28) with the property of interest.
2. The method according to claim 1 in which providing the group of cells (18) labeled with more than one distinct elemental tag (Tn) comprises labeling the group of cells (18) with more than one elemental conjugated antibody, each of the more than one elemental conjugated antibody comprising one or more distinct elemental tag (Tn).
3. The method according to claim 2 in which the one or more distinct elemental tag (Tn) is selected from a group comprising transitional metals.
4. The method according to claim 3 in which correlating the detected group of elemental ions (28) with the property of interest comprises generating elemental tag data (30) from the detected elemental ions (24) and recording the elemental tag data against the property of interest.
5. The method according to claim 4 in which the group of cells (18) comprises more than one cell subgroup, each cell subgroup labeled with more than one distinct elemental tag (Tn).
6. The method according to claim 5 further comprising identifying the more than one cell subgroup according to the property of interest.

7. The method according to claim 6 in which the property of interest is identified by one or more of a fluorescence, a phosphorescence, a reflection, an absorption, a shape recognition, a physical feature, or a combination thereof.
8. The method according to claim 4 further comprising representing the location (22) of the candidate cell (20) in two-dimensional space within the group of cells (18).
9. The method according to claim 4 further comprising representing the location (22) of the candidate cell (20) in three-dimensional space within the group of cells (18).
10. The method according to claim 8 or 9 further comprising preparing the group of cells (18) with the property of interest.
11. The method according to claim 10 in which the property of interest is identified by one or more of a fluorescence, a phosphorescence, a reflection, an absorption, a shape recognition, a physical feature, or a combination thereof.
12. The method according to claim 10 in which the candidate cell (20) is identified by fluorescent emission.
13. The method according to claim 12 in which the group of cells (18) is a tissue sample.
14. A system for elemental tagged cell analysis comprising:
  - at least one interrogator (19) configured to identify the location (22) of a candidate cell (20);
  - a data source (21) having a format to record the location (22) of the candidate cell (20);
  - a laser ablation system (23) interfaced with the data source (21), the laser ablation system (23) configured to direct at least one laser pulse (24) at the location (22) of the candidate cell (20) once it has been identified by the interrogator (19); and
  - a mass cytometer (16) coupled to the laser ablation system (23), the mass cytometer (16) configured to detect an elemental tag associated with the candidate cell (20).
15. The system according to claim 14 wherein the at least one interrogator (19) is configured to identify the location (22) of the candidate cell having a property of interest and the data source (21) is further formatted to record the property of interest.
16. The system according to claim 15 further comprising a control system (34) configured to interface the laser ablation system (23) with the data source (21).
17. The system according to claim 16 wherein the control system (34) is further configured to access the data source (21) and to direct the at least one laser pulse (24) at the location (22) of the candidate cell.

18. The system according to claim 15 wherein the at least one interrogator (19) is selected from an optical microscope, a fluorescence microscope, an electron microscope, a confocal microscope, and any combination thereof.
19. The system according to claim 14 wherein the data source (21) comprises a format selected from alphanumeric, emission image, barcode, radio frequency identification (RFID), and any combination thereof.
20. The system according to claim 14 wherein the mass cytometer comprises (16) an ion detector and a total path defined between the location of the candidate cell and the ion detector, the total path being configured to enable a combined delay time of between 20 and 200 msec.