

CLAIMS

What is currently claimed:

1. A biological expression mapping system configured to spatially map one or more biological expressions of respective target biological components contained in a tissue sample to an image of the tissue sample, the system comprising at least one processor having instructions operational thereon that, when executed, are configured to cause the system to:

display, in a first display, a scans pane which includes at least the image of the tissue sample, the image including one or more demarcations each corresponding to a particular one of one or more regions-of-interest (ROIs), each of the one or more ROIs corresponding to a specific portion of the tissue within the tissue image;

display, in a second display, a visualization pane comprising a visualization of each of the respective biological expressions contained in the one or more ROIs;

and

augment the first display by coding the one or more ROIs in the tissue image to show the spatial mapping of the biological expressions within the one or more ROIs.
2. The system of claim 1, wherein coding comprises at least color-coding.
3. The system of claims 1 or 2, wherein the visualization of each of the respective biological expressions includes an image of a biological expression contained in an ROI of the one or more ROIs.
4. The system of any of claims 1-3, wherein the visualization comprises at least one of a graph, a plot, a diagram, and a map of the one or more biological expressions contained in the one or more ROIs.
5. The system of claim 4, wherein the graph, the plot, the diagram, and the map of the biological expressions comprise at least one of a heat-map, a tree diagram, a bar chart,

a scatter plot, a box plot, a forest plot, a principal component, a statistical plot, a volcano plot, a trend plot, and a strip plot.

6. The system of claim 5, wherein the tree diagram includes a dendrogram.
7. The system of claim 5, wherein the statistical plot includes one or more principal component analysis (PCA) plots.
8. The system of any of claims 1-7, wherein the first display is augmented based upon user input specifying at least one selection of a biological expression contained in the visualization.
9. The system of claim 8, wherein the spatial mapping of the at least one user selected biological expression is configured to provide spatial context thereof to at least one of the one or more of the ROIs.
10. The system of any of claims 1-9, wherein augmenting the first display is configured to facilitate morphological profiling of tissue in at least one of the one or more ROIs.
11. The system of claim 10, wherein morphological profiling comprises at least one of geometric profiling, segment profiling, contour profiling, gridded profiling, and cell profiling.
12. The system of claim 10, wherein segment profiling comprises at least one of manual segment profiling and automatic segment profiling, the automatic segment profiling configured to automate and facilitate segment profiling of tissue in at least one of the one or more ROIs based on user input specifying at least one segment profiling parameter.

13. The system of claim 10, wherein cell profiling comprises single cell profiling and rare cell profiling.
14. The system of any of claims 1-13, wherein:
 - the one or more biological expressions of the respective one or more target biological components at least within the one or more ROIs are determined based upon exposing the tissue sample to a plurality of reagents,
 - and
 - the reagents include:
 - a plurality of imaging reagents configured to bind to biological boundaries of the tissue sample within at least the one or more ROIs, and
 - a plurality of profiling reagents, each profiling reagent is configured to:
 - bind to a specific biological expression of a specific target biological component contained within at least the one or more ROIs, and
 - include a cleavable, associated oligonucleotide.
15. The system of claim 14, wherein, after exposing the tissue sample to the plurality of reagents, and prior to displaying in the first display and the second display, the instructions are further configured to cause the system to:
 - illuminate and image the tissue sample;
 - receive user input specifying a selection of the one or more ROIs;
 - irradiate the tissue sample at least at one or more of the ROIs to thereby cleave the associated oligonucleotides from the profiling reagents;
 - collect the cleaved oligonucleotides;
 - and
 - analyze the collected, cleaved associated oligonucleotides to determine:
 - the one or more biological expressions contained within at least the one or more ROIs, and

their corresponding location therein.

16. The system of claim 14, wherein each profiling reagent comprises:
a nucleic acid probe including a target binding region in which the cleavable, associated oligonucleotide is removably linked; or
an oligonucleotide including a removably linked antibody.
17. The system of claim 8, wherein the user input specifying the selection of the one or more ROIs includes a selection of one or more of the ROIs with respect to shape or size.
18. The system of any of claims 1-17, wherein the instructions are further configured to cause the system to:
display, in a third display, a datasets pane which includes at least one user-selectable dataset, the at least one dataset associated with one or more of the biological expressions contained in the one or more ROIs.
19. The system of claim 18, wherein the instructions are further configured to cause the system to:
display, in a fourth display, a records pane which includes a plurality of scanning records, each containing at least one tissue image.
20. The system of claim 19, wherein one or more of the first display, the second display, the third display, and the fourth display are provided within a unified user interface configured to interactively associate, based on user input, one or more of the tissue image, the visualizations, the user-selectable datasets, and one or more of the plurality of scanning records.

21. The system of claim 20, wherein the unified user interface is configured as a single display.
22. The system of claim 20, wherein the first display, the second display, the third display, and the fourth display respectively correspond to one or more portions of the single display.
23. The system of claim 18, wherein the instructions are further configured to cause the system to:

select, based on user input, at least one record, such that, upon selection thereof, at least one of the scans pane, the visualization pane, and the datasets pane is displayed in a respective display.
24. The system of claim 19, wherein the instructions are further configured to cause the system to filter, based on user input, at least one of a property, a constraint, and a value for the plurality of records.
25. The system of any of claims 1-24, wherein the scans pane further includes a plurality of icons each corresponding to a specific segment within at least one of the one or more ROIs or the overall tissue image.
26. The system of claim 21, wherein the instructions are further configured to cause the system to render, for display via the unified user interface and in real-time based on user input, the scans pane in conjunction with the visualization pane and one or more of the datasets pane and the records pane.
27. The system of any of claims 1-26, wherein coding the one or more ROIs includes presenting a quantitative measurement of the biological expressions.

28. The system of claim 2, wherein color-coding the one or more ROIs includes presenting a quantitative measurement of the biological expressions.
29. The system of claim 27, wherein the quantitative measurement corresponds to at least one of a type and degree of respective biological expressions.
30. The system of claim 28, wherein the quantitative measurement corresponds to at least one of a type and degree of respective biological expressions.
31. The system of claim 30, wherein the type or degree corresponds to a particular color for each respective biological expression or an intensity of a color for each respective biological expression.
32. A non-transitory processor-readable medium storing code representing instructions, the instructions configured to be executed by a processor of a biological expression mapping system, and the biological expression mapping system configured to spatially map one or more biological expressions of respective target biological components contained in a tissue sample to an image of the tissue sample, the instructions, when executed, configured to cause the system to:
 - display, in a first display, a scans pane which includes at least the image of the tissue sample, the image including one or more demarcations each corresponding to a particular one of one or more regions-of-interest (ROIs), each of the one or more ROIs corresponding to a specific portion of the tissue within the tissue image;
 - display, in a second display, a visualization pane comprising a visualization of each of the respective biological expressions contained in the one or more ROIs;
 - and
 - augment the first display by coding the one or more ROIs in the tissue image to show the spatial mapping of the biological expressions within the one or more ROIs.

33. A method, comprising:
- displaying, in a first display, a scans pane which includes at least the image of the tissue sample, the image including one or more demarcations each corresponding to a particular one of one or more regions-of-interest (ROIs), each of the one or more ROIs corresponding to a specific portion of the tissue within the tissue image;
- displaying, in a second display, a visualization pane comprising a visualization of each of the respective biological expressions contained in the one or more ROIs;
- and
- augmenting the first display or the second display by coding the one or more ROIs in the tissue image to show the spatial mapping of the biological expressions within the one or more ROIs.
33. A system, apparatus, method and/or non-transitory computer readable medium according to any of the embodiments disclosed herein.