

Loon

Using Exemplars to Visualize Large-Scale Microscopy Data

Devin Lange, Eddie Polanco, Robert Judson-Torres, Thomas Zangle, Alexander Lex

<http://loon.sci.utah.edu/>



visualization
design lab



Zangle Lab
Department of Chemical Engineering
THE UNIVERSITY OF UTAH



UNIVERSITY OF UTAH
HUNTSMAN
CANCER INSTITUTE



HEALTH
UNIVERSITY OF UTAH

Motivation
Improve Cancer Treatment

Motivation - Improve Cancer Treatment

Challenges:



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Challenges:

- **Cancer is heterogeneous**



Motivation - Improve Cancer Treatment

Challenges:

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- **Many treatment options exist**



Motivation - Improve Cancer Treatment

Challenges:

- Cancer is heterogeneous
- Many treatment options exist



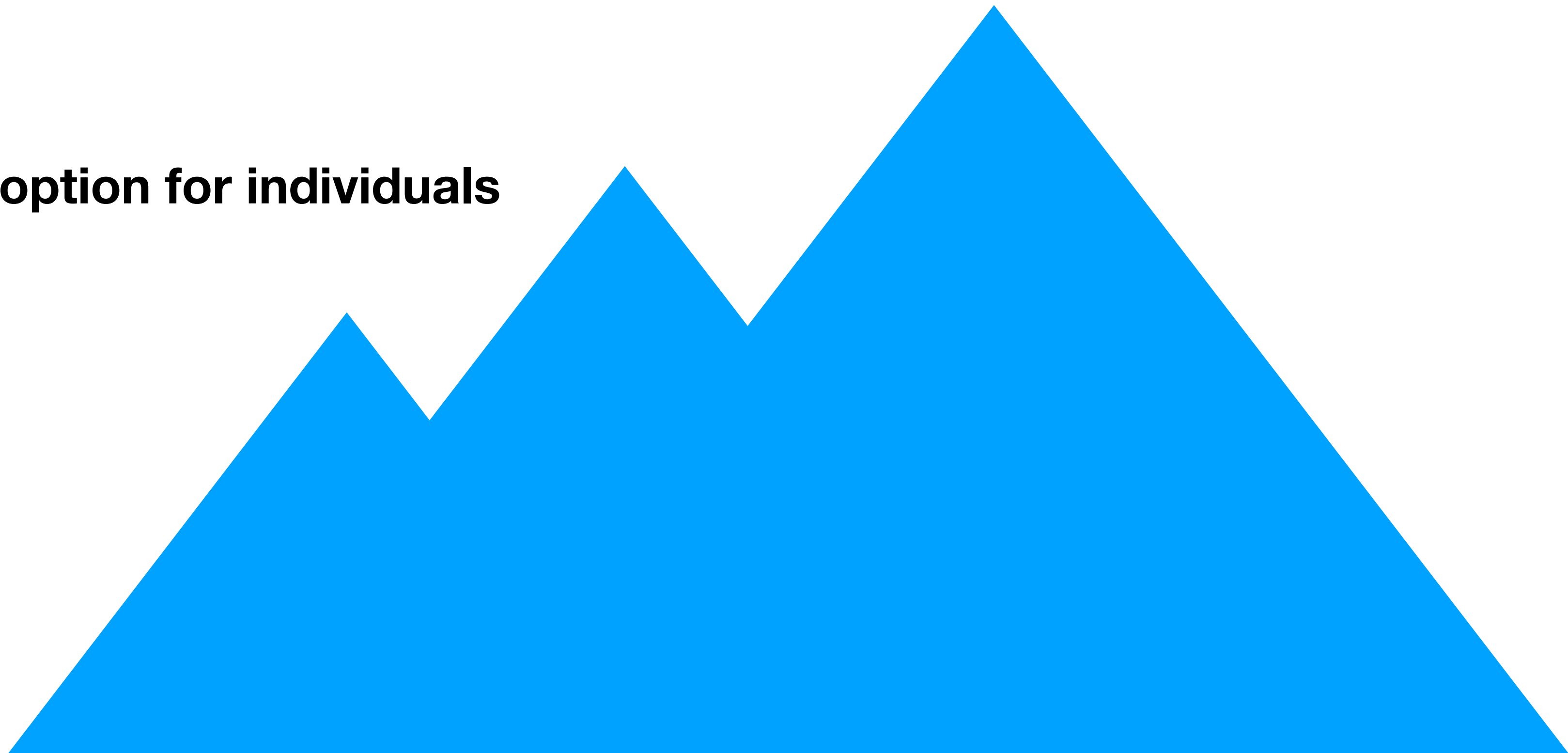
Motivation - Improve Cancer Treatment

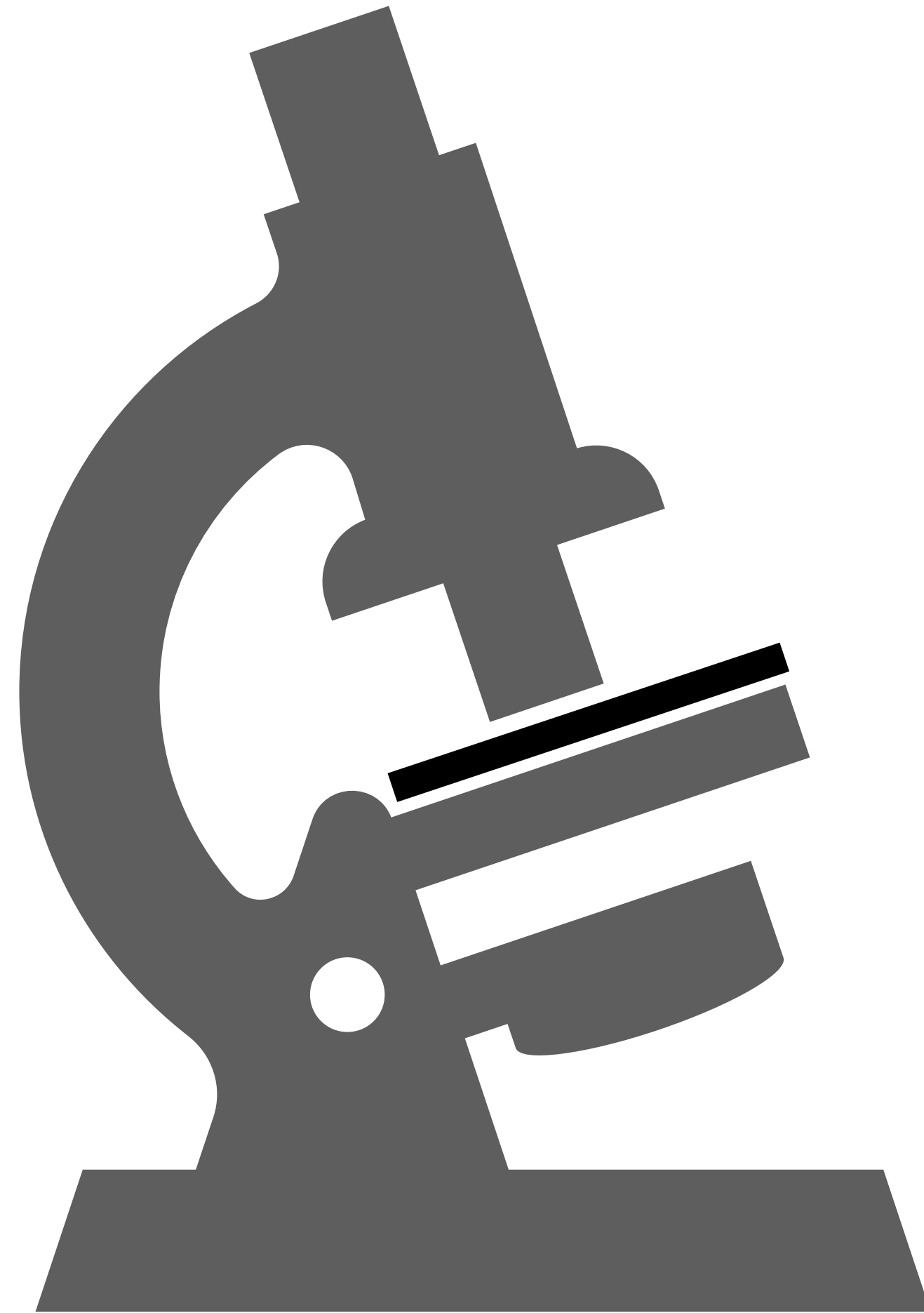
Challenges:

- Cancer is heterogeneous
- Many treatment options exist

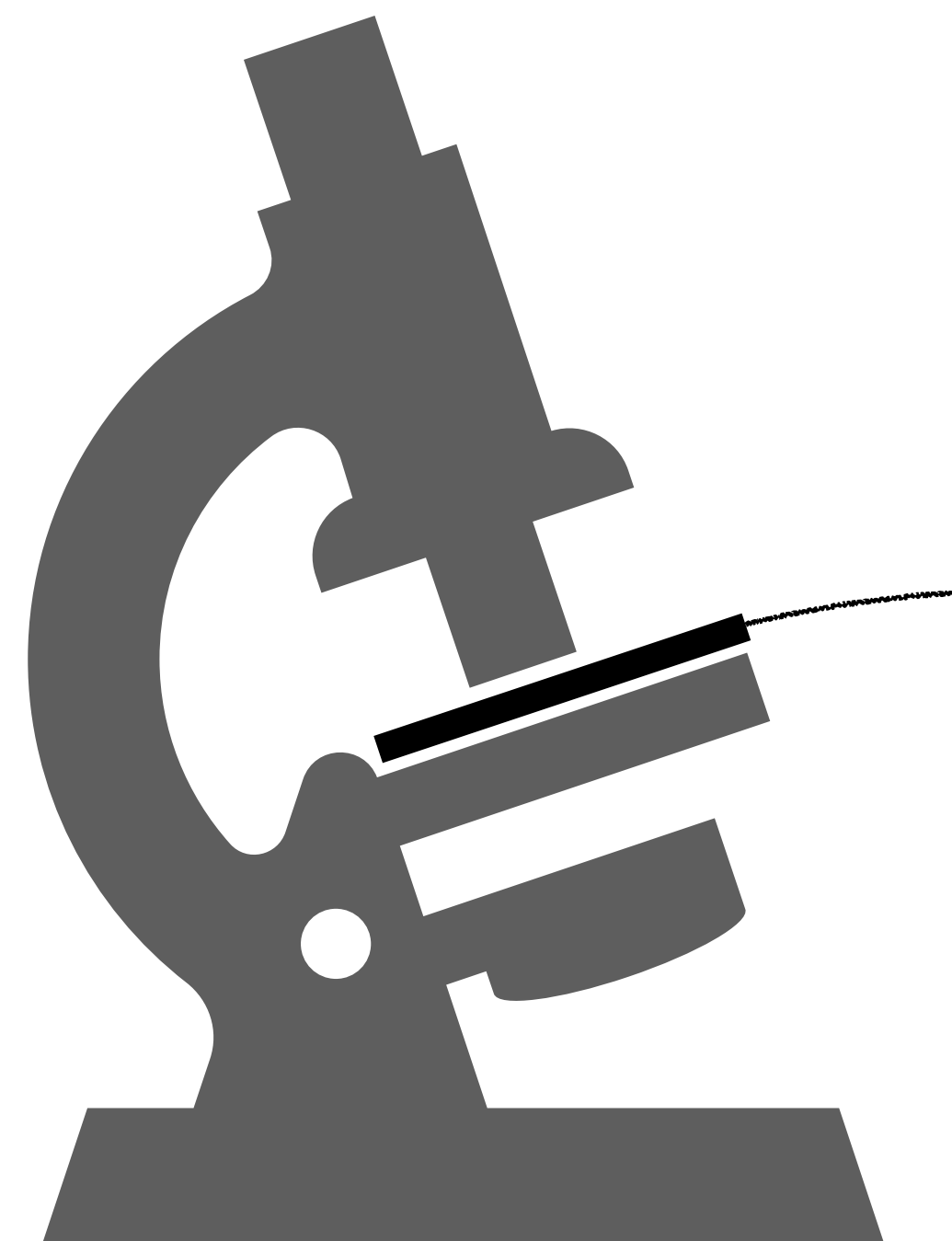
Goal:

- **Identify effective treatment option for individuals**

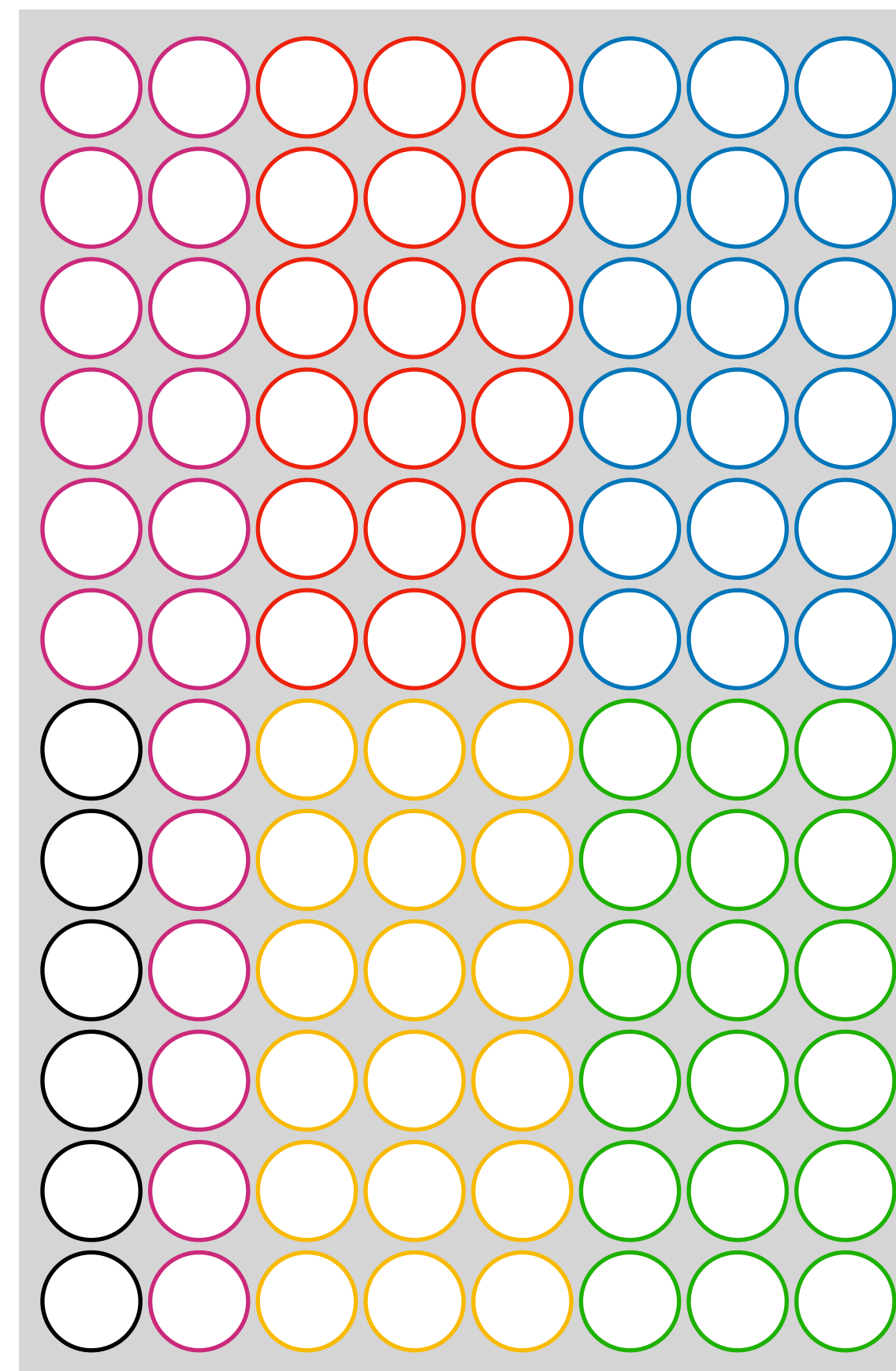




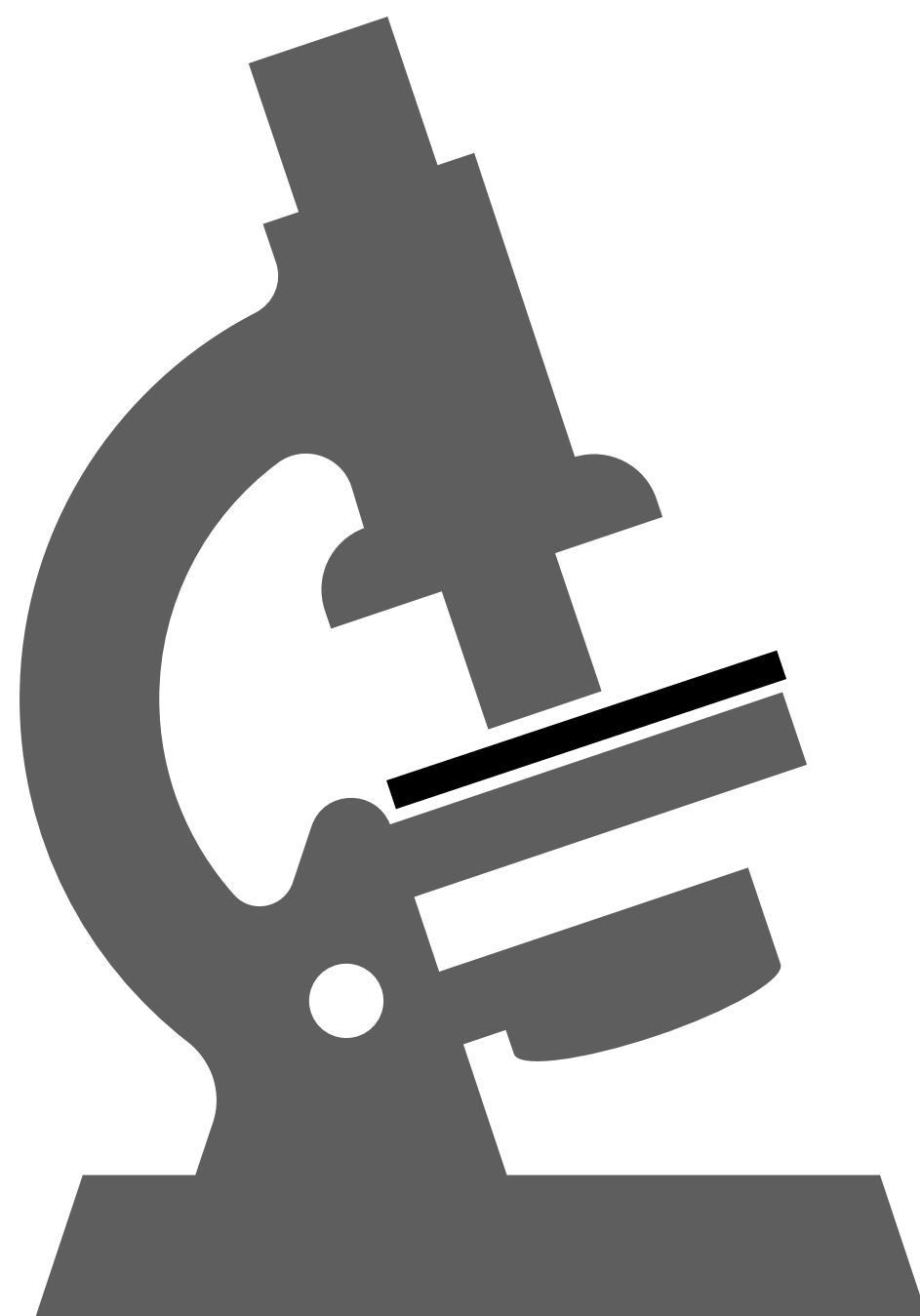
Quantitative Phase Microscope



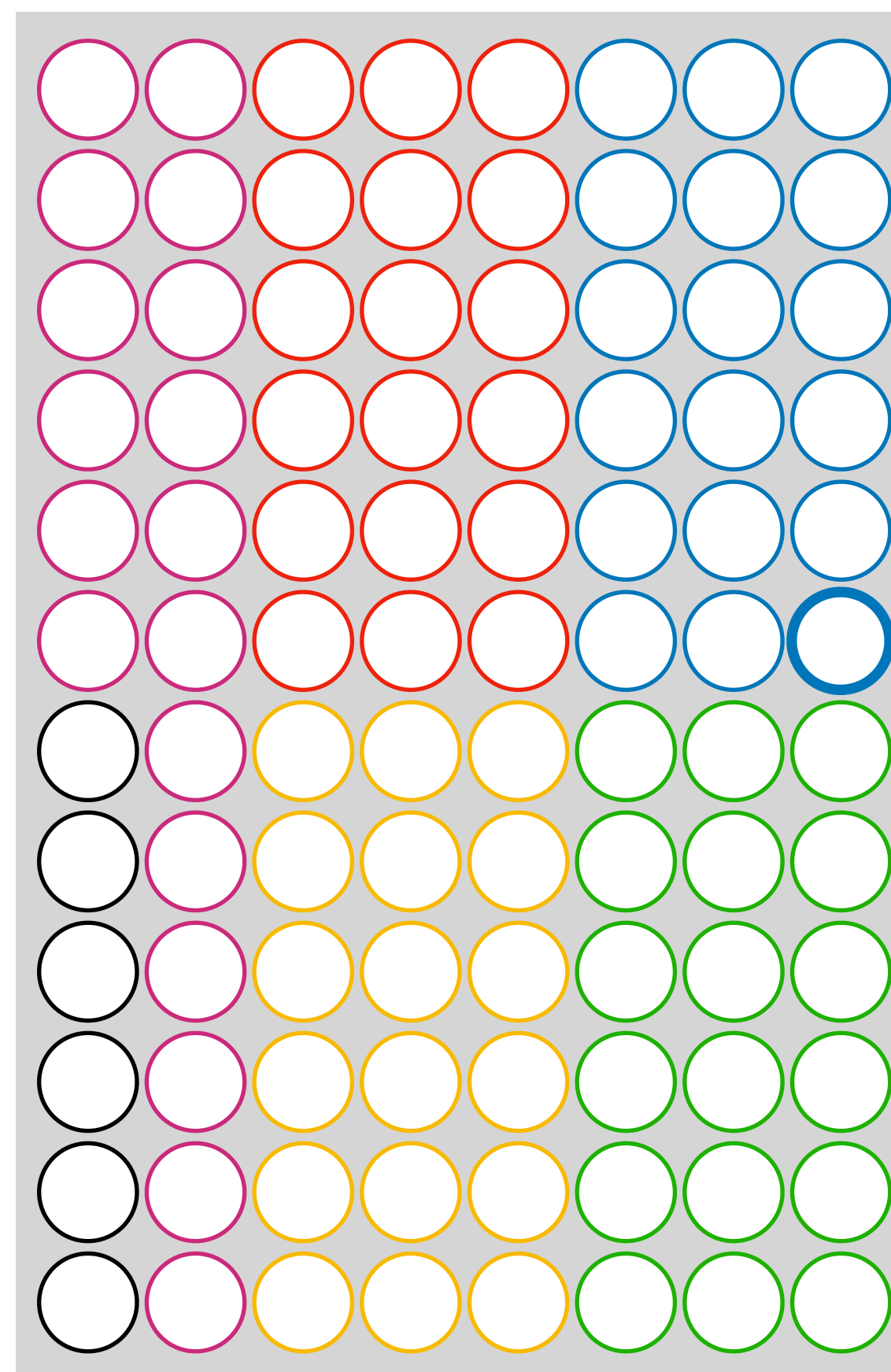
**Quantitative
Phase
Microscope**



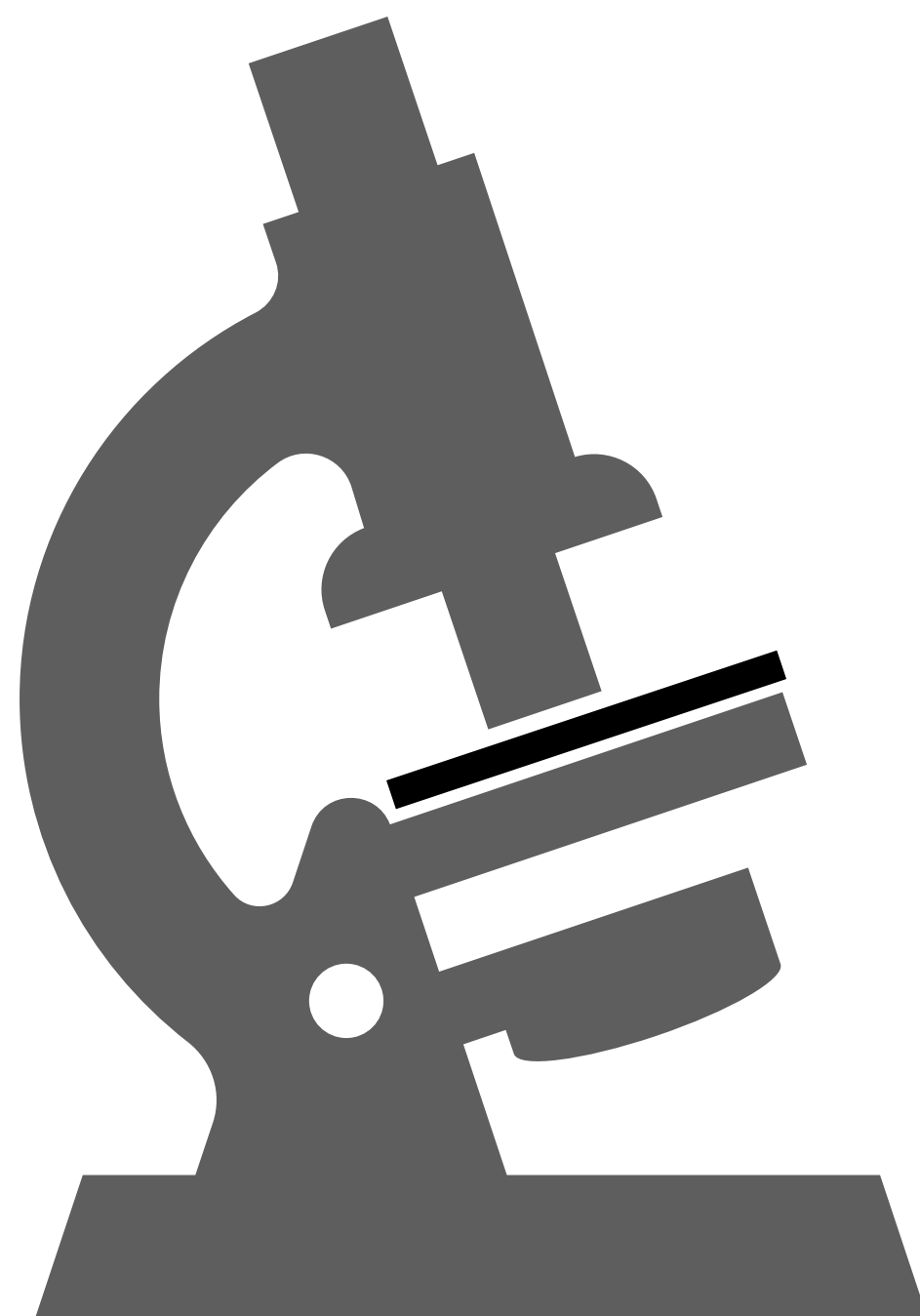
96-Well Plate



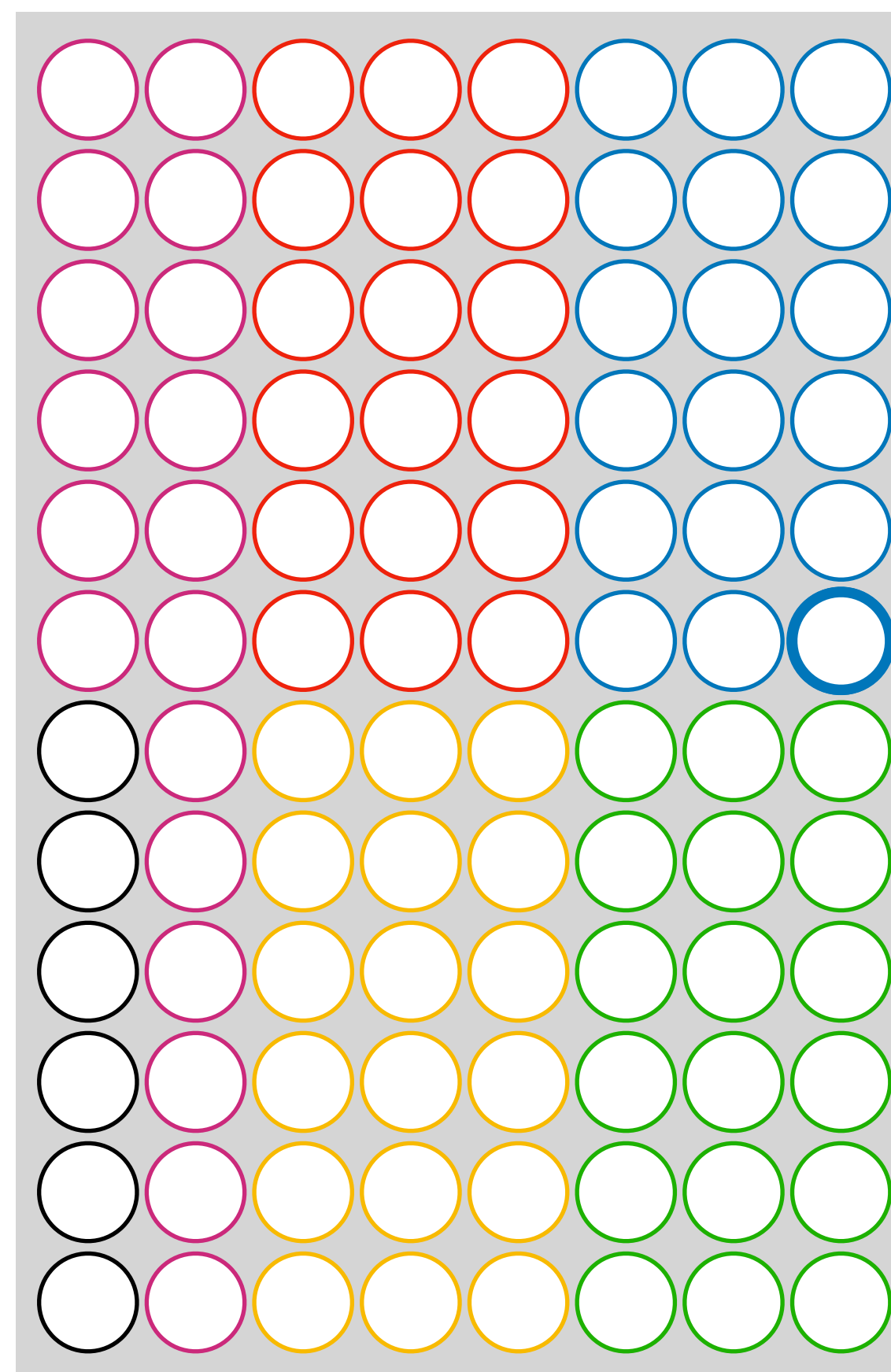
**Quantitative
Phase
Microscope**



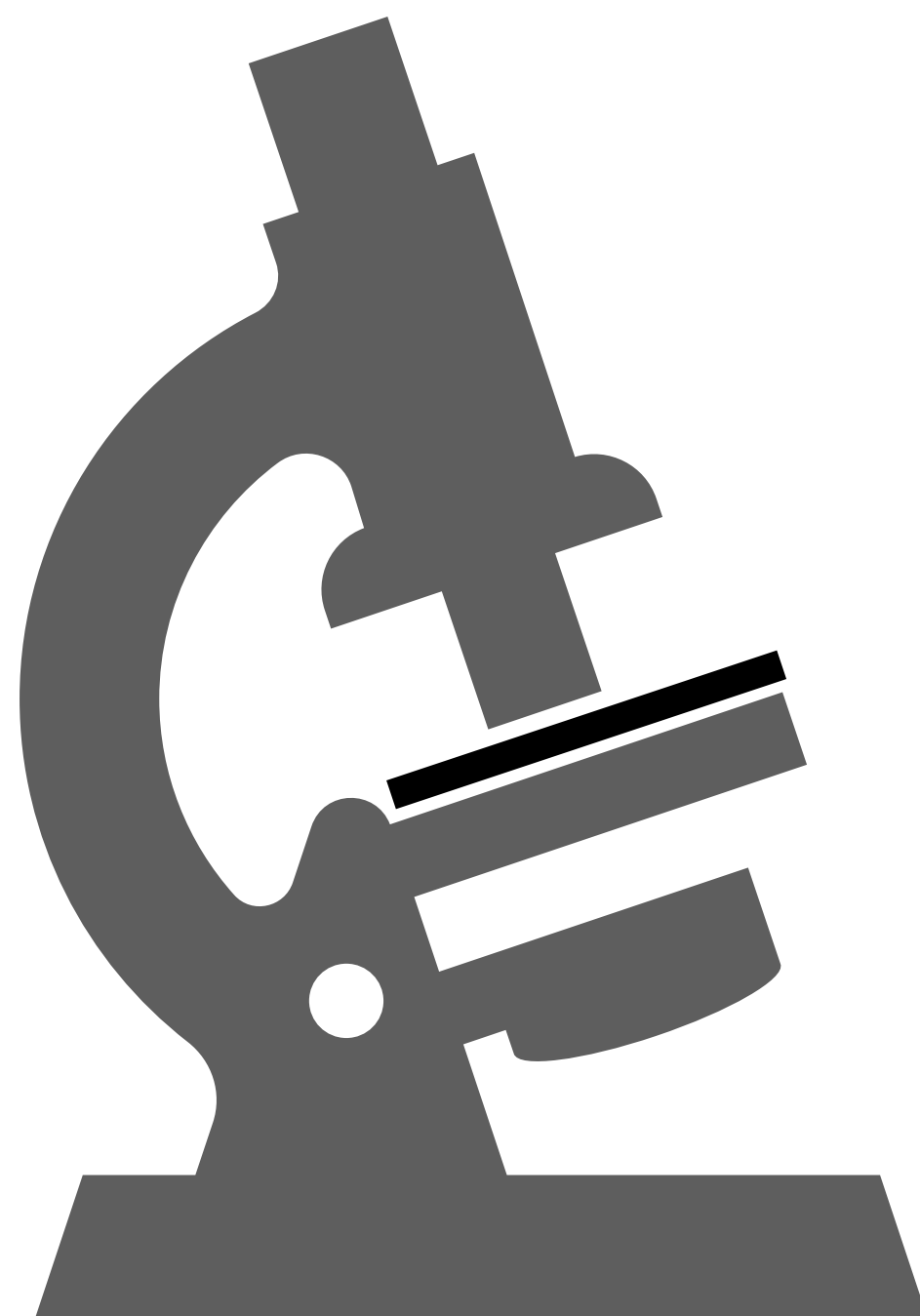
96-Well Plate



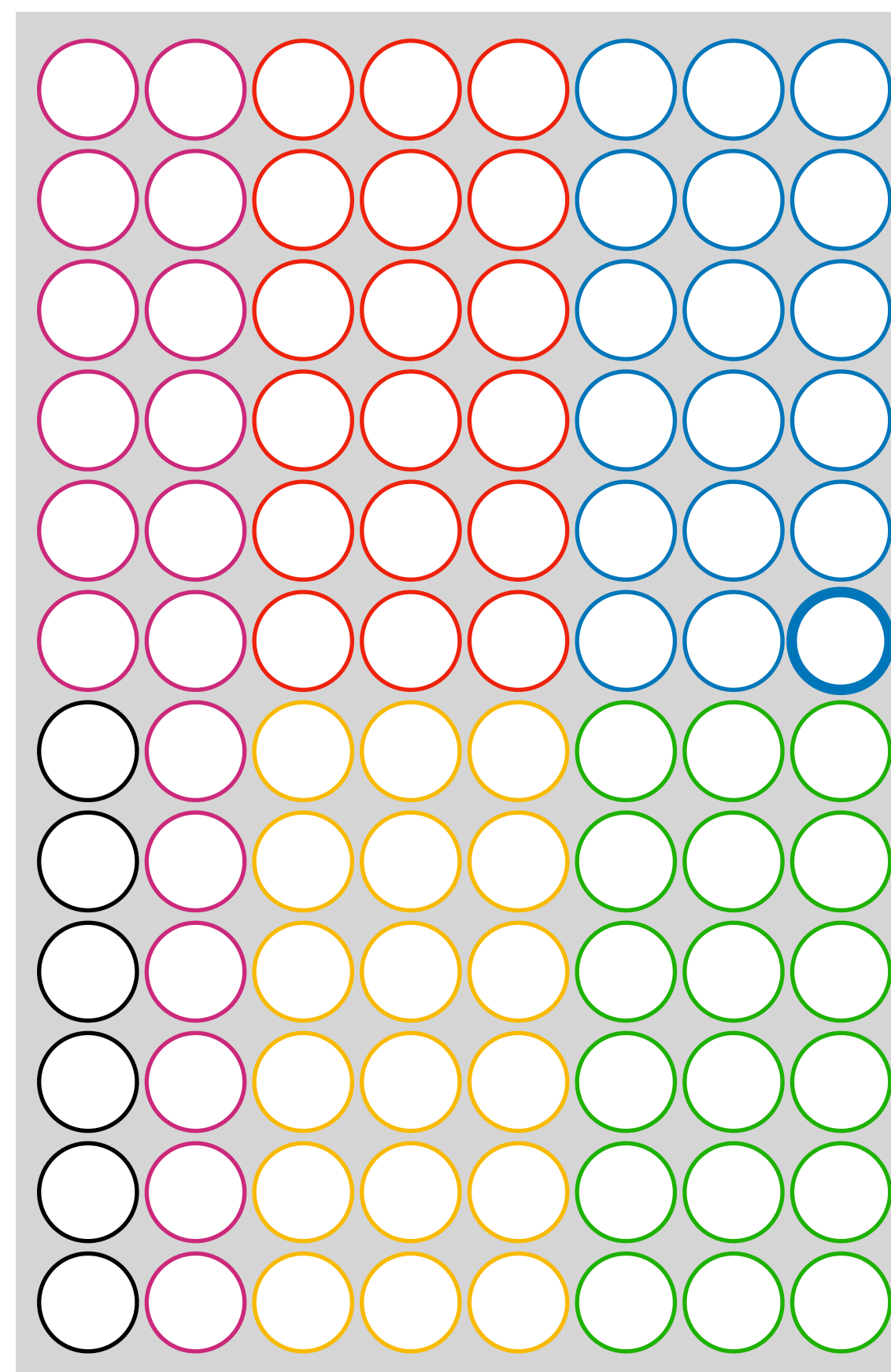
**Quantitative
Phase
Microscope**



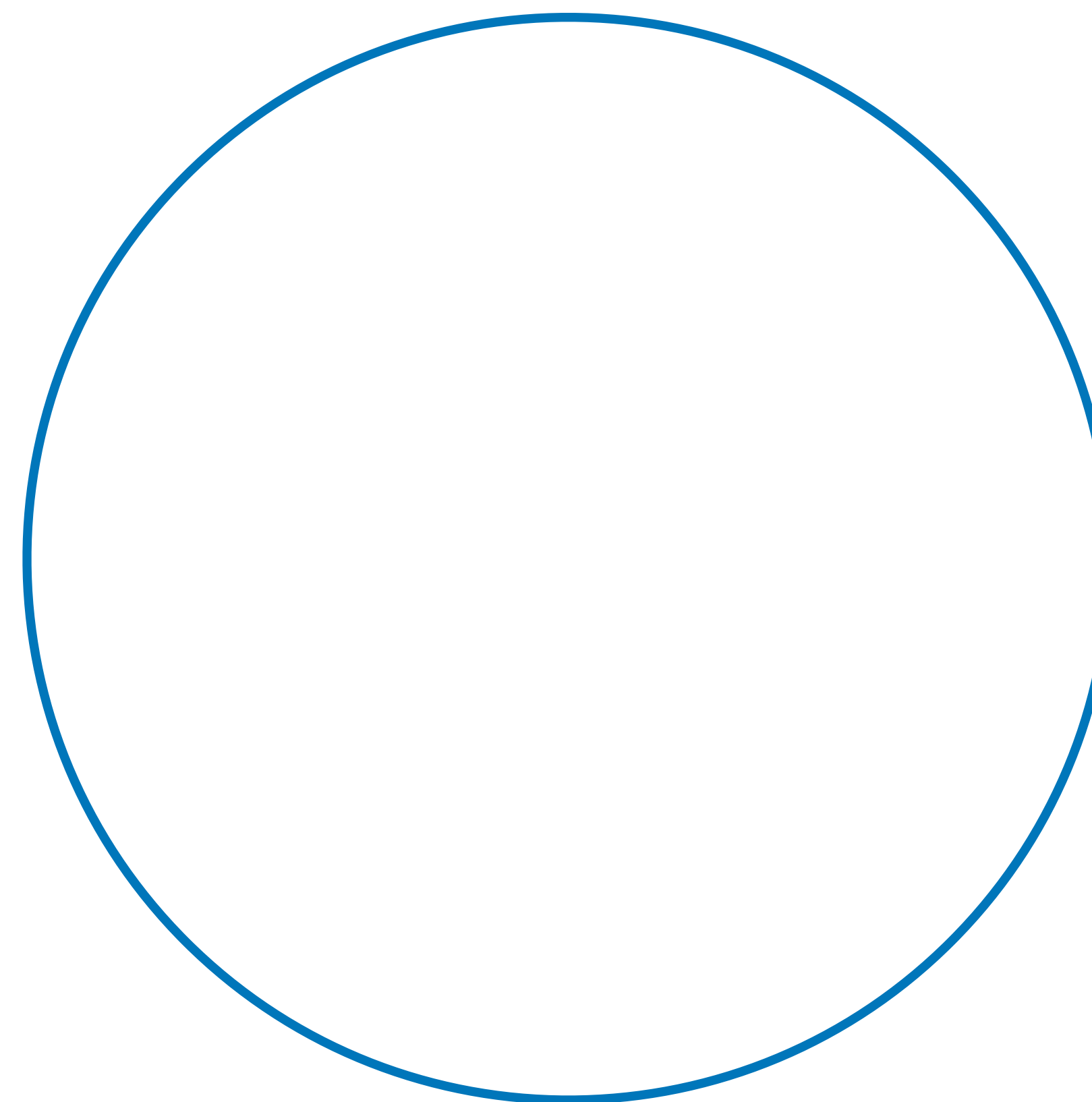
96-Well Plate



**Quantitative
Phase
Microscope**

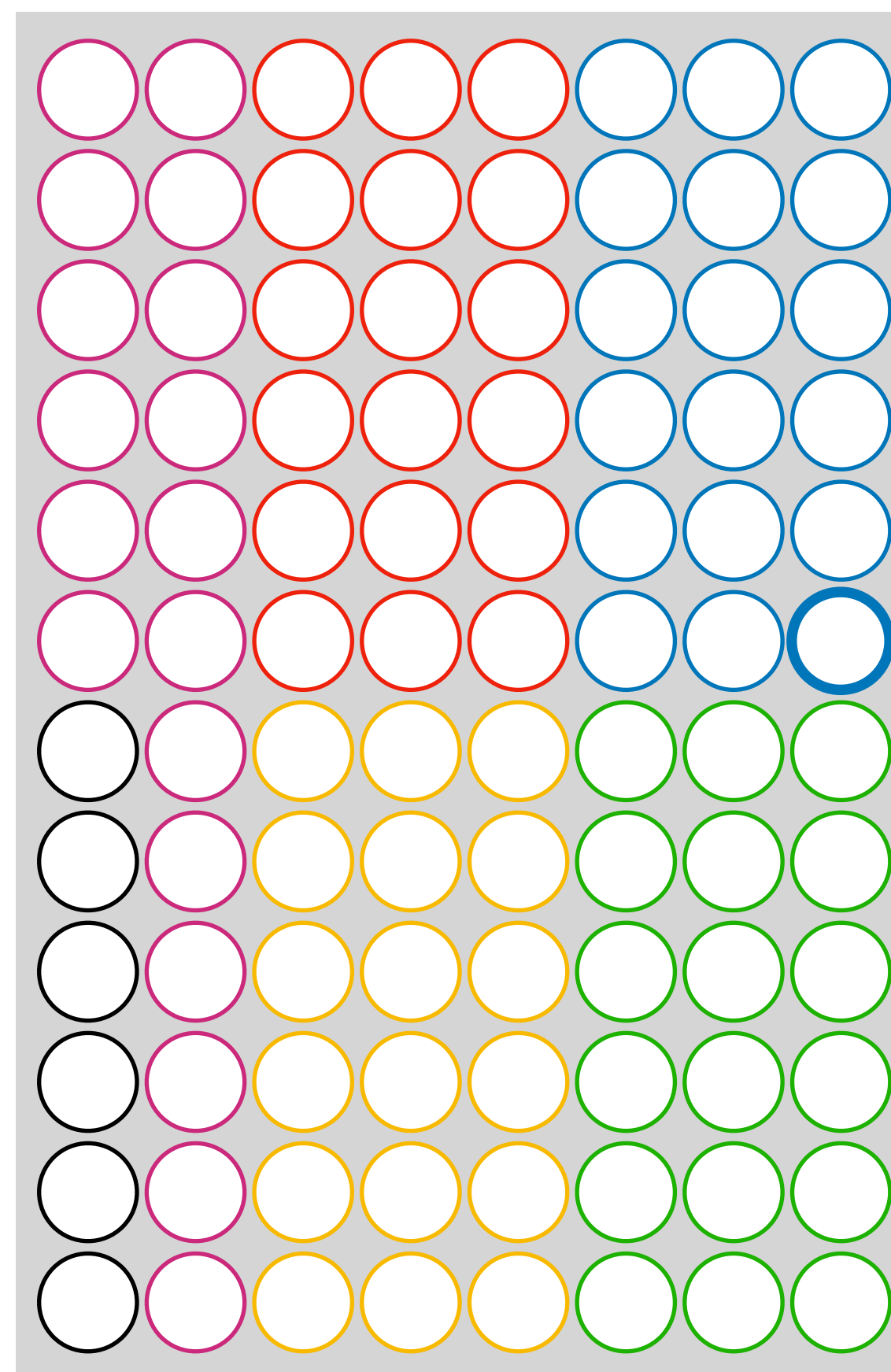


96-Well Plate

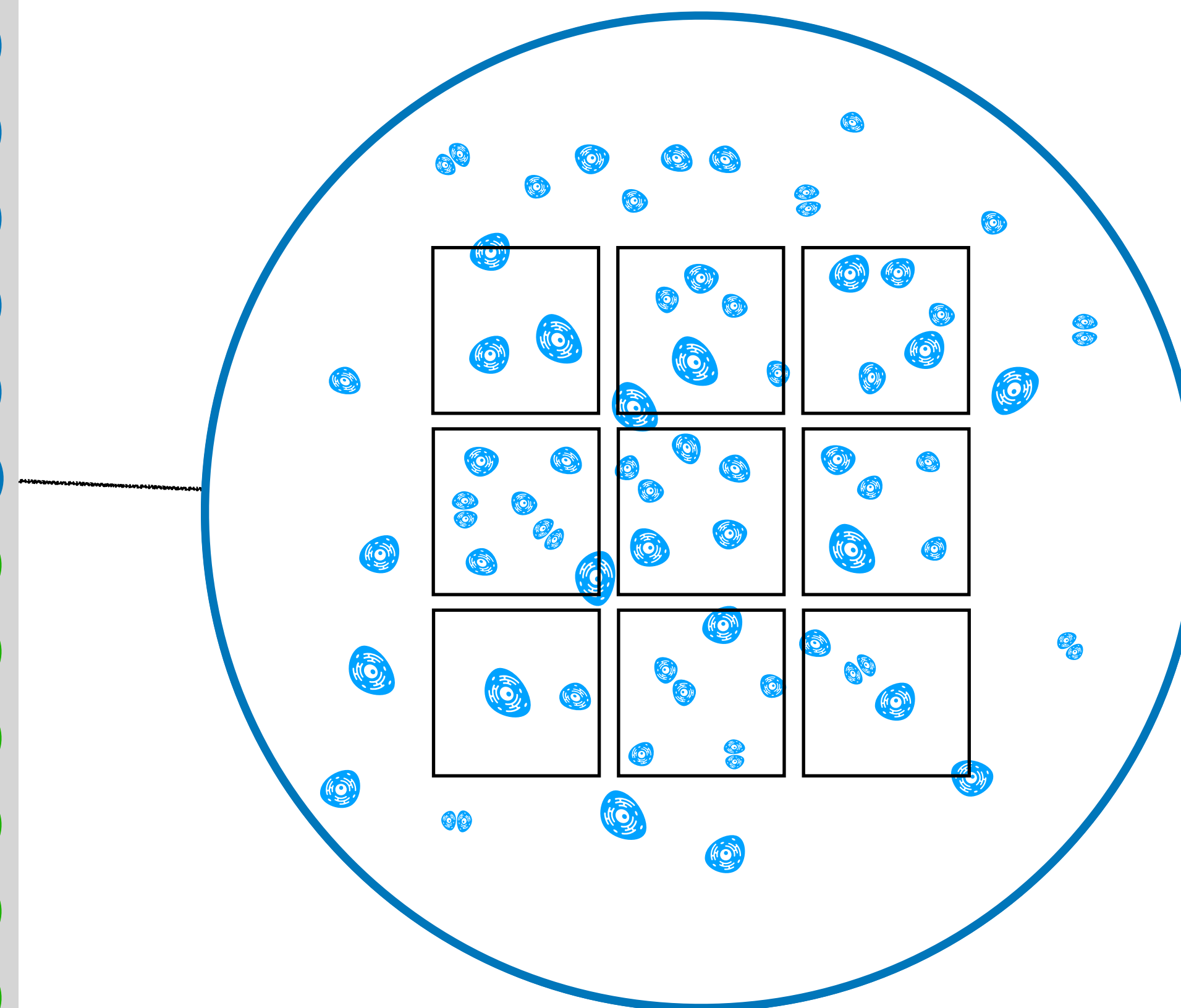




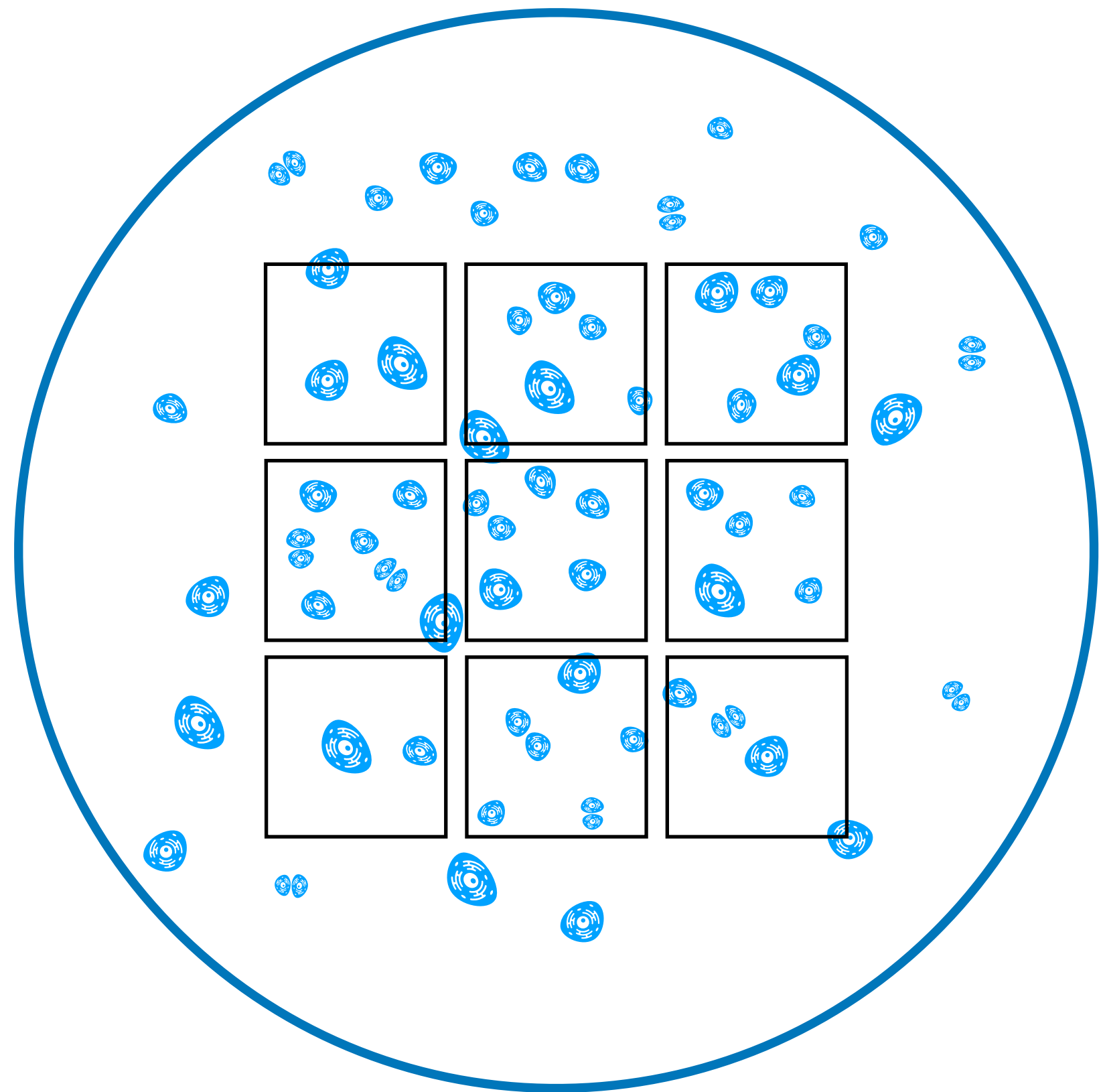
**Quantitative
Phase
Microscope**



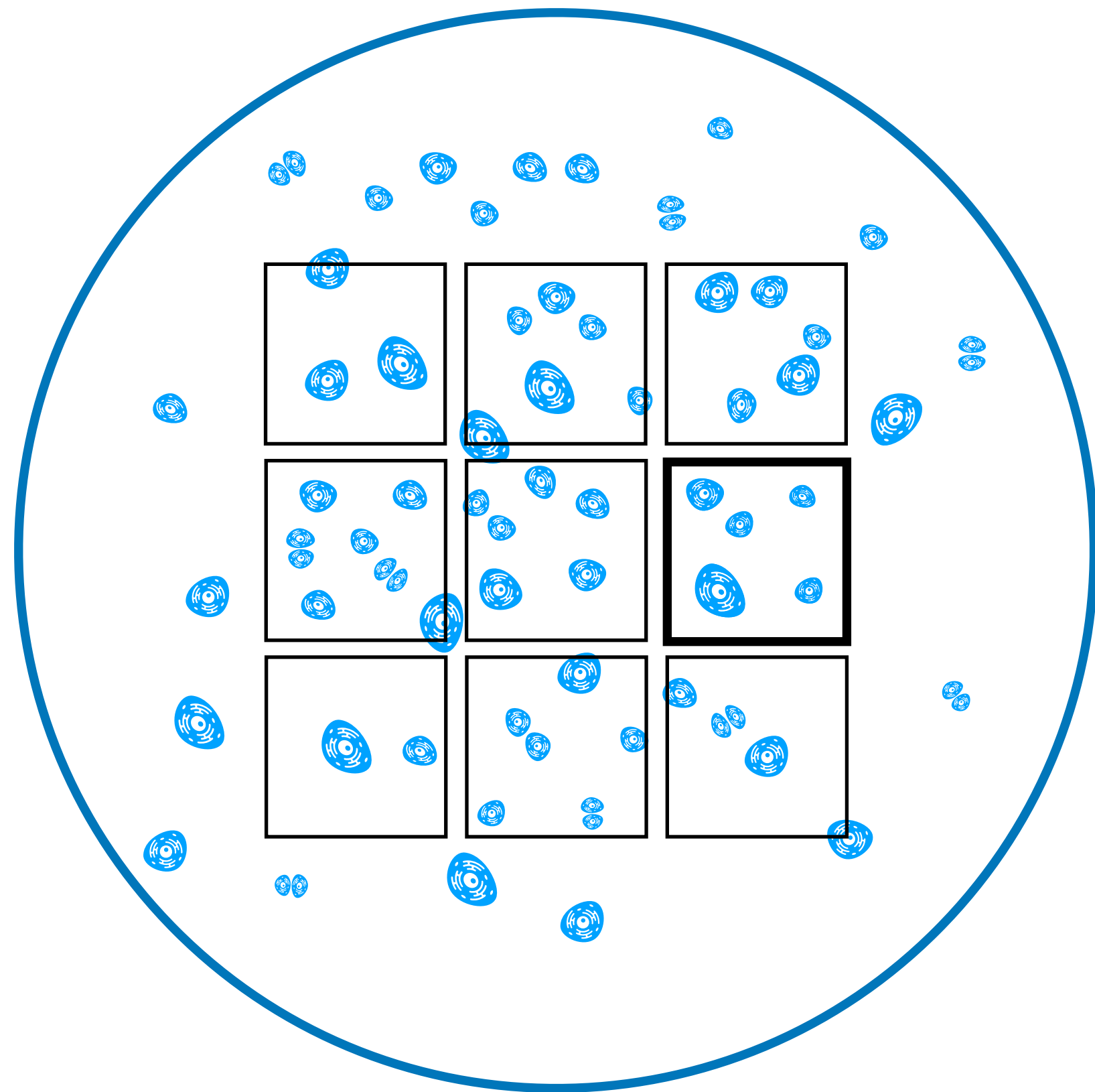
96-Well Plate



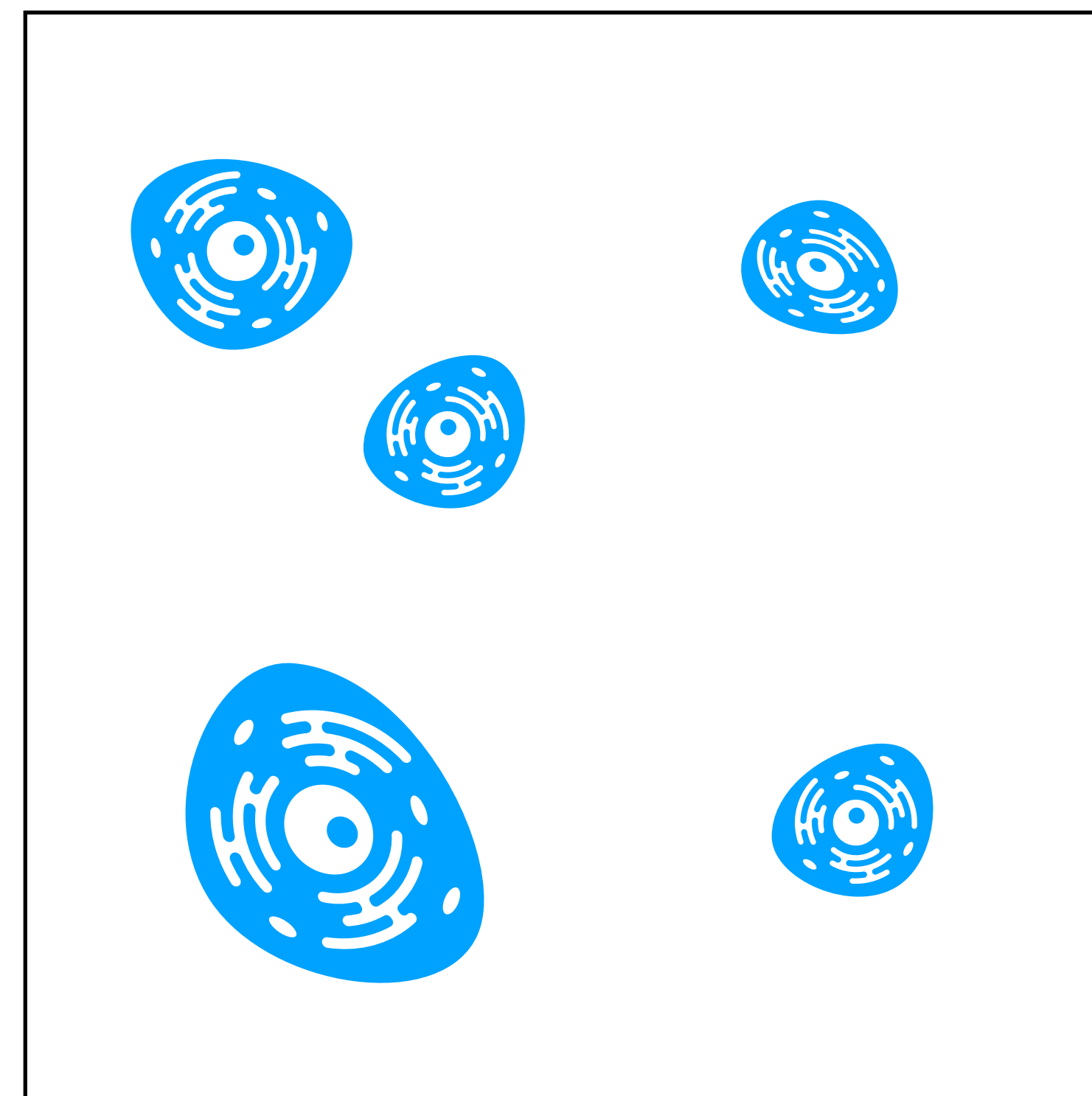
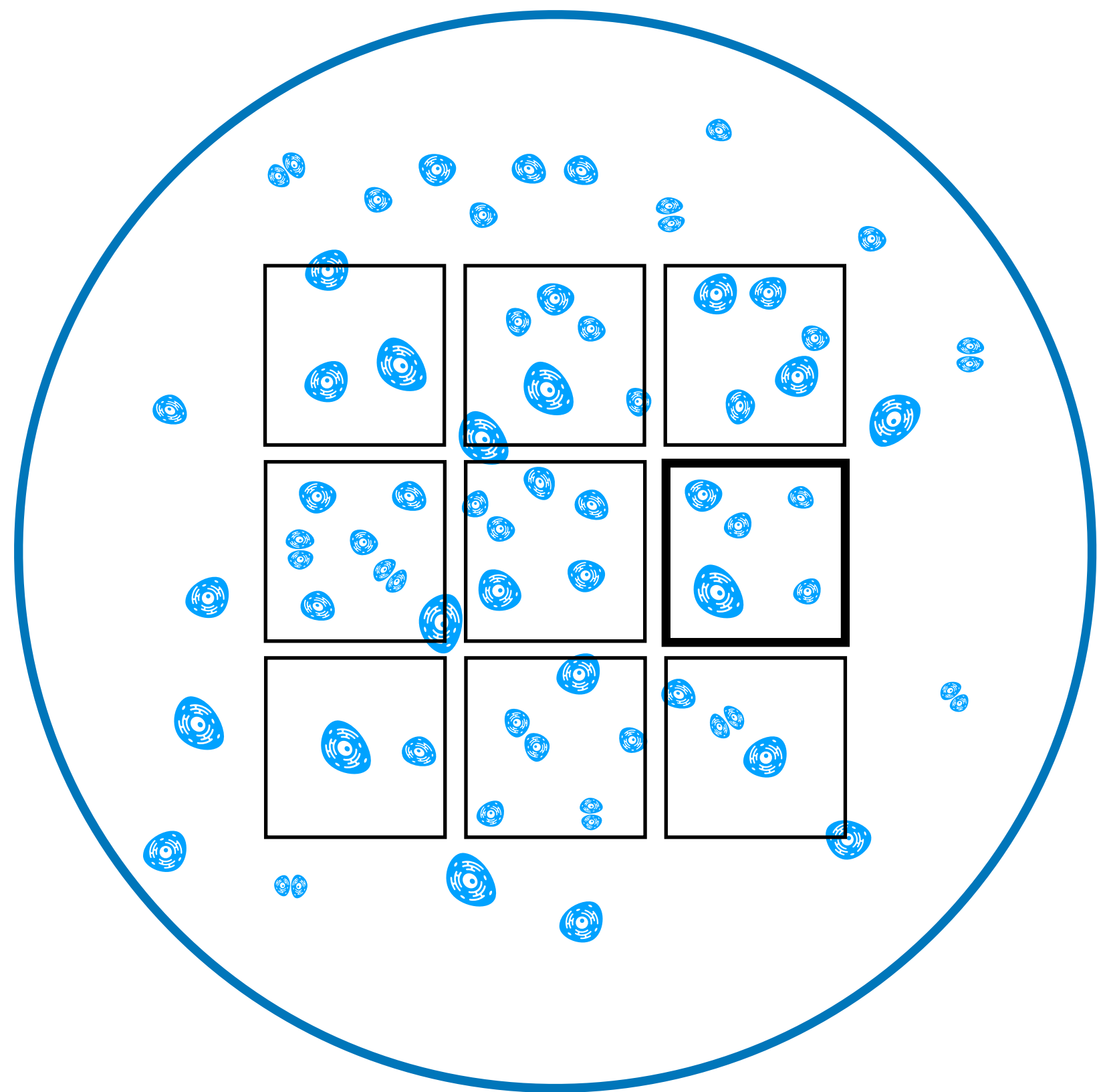
Imaging a Single Well



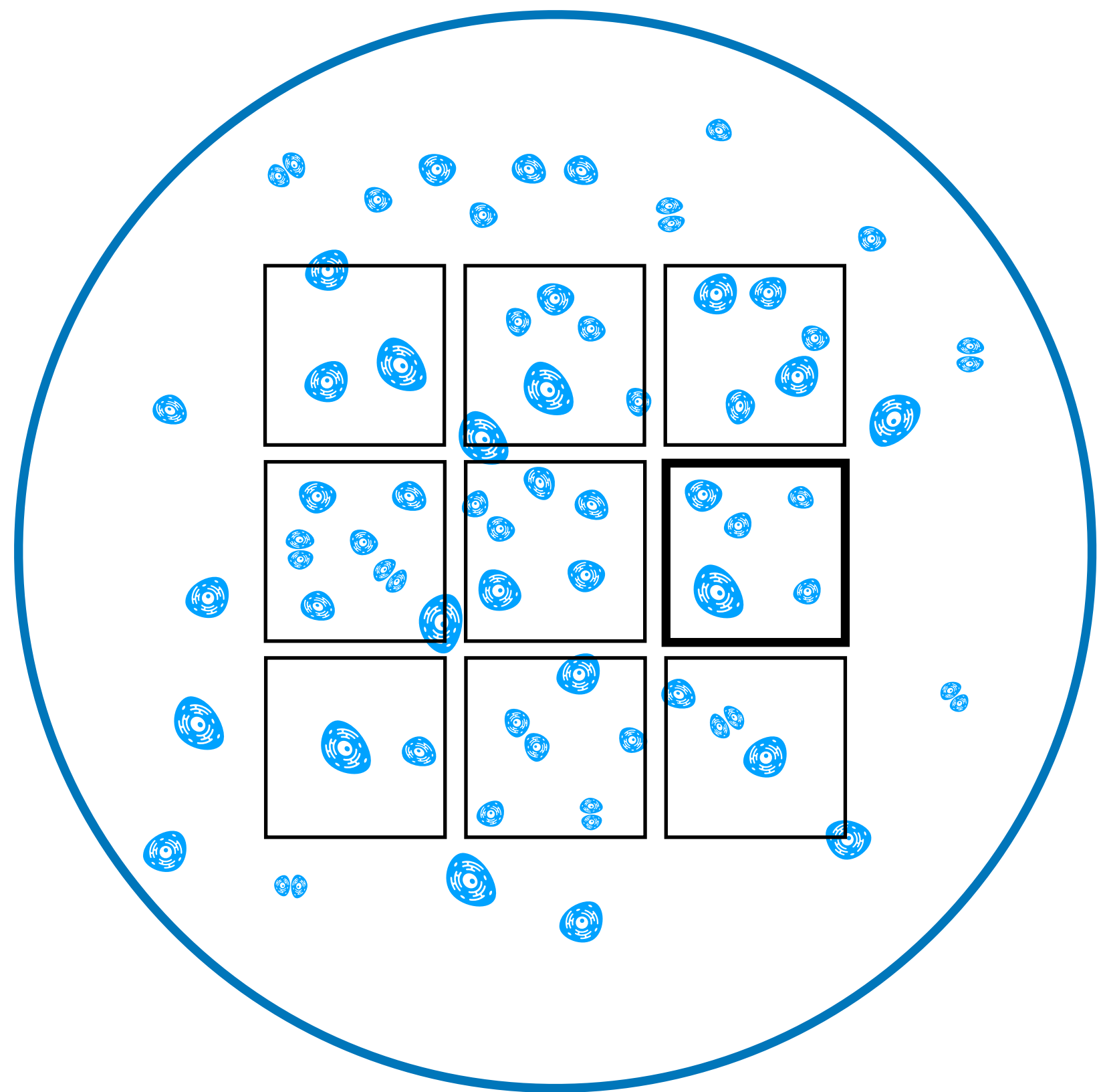
Imaging a Single Well



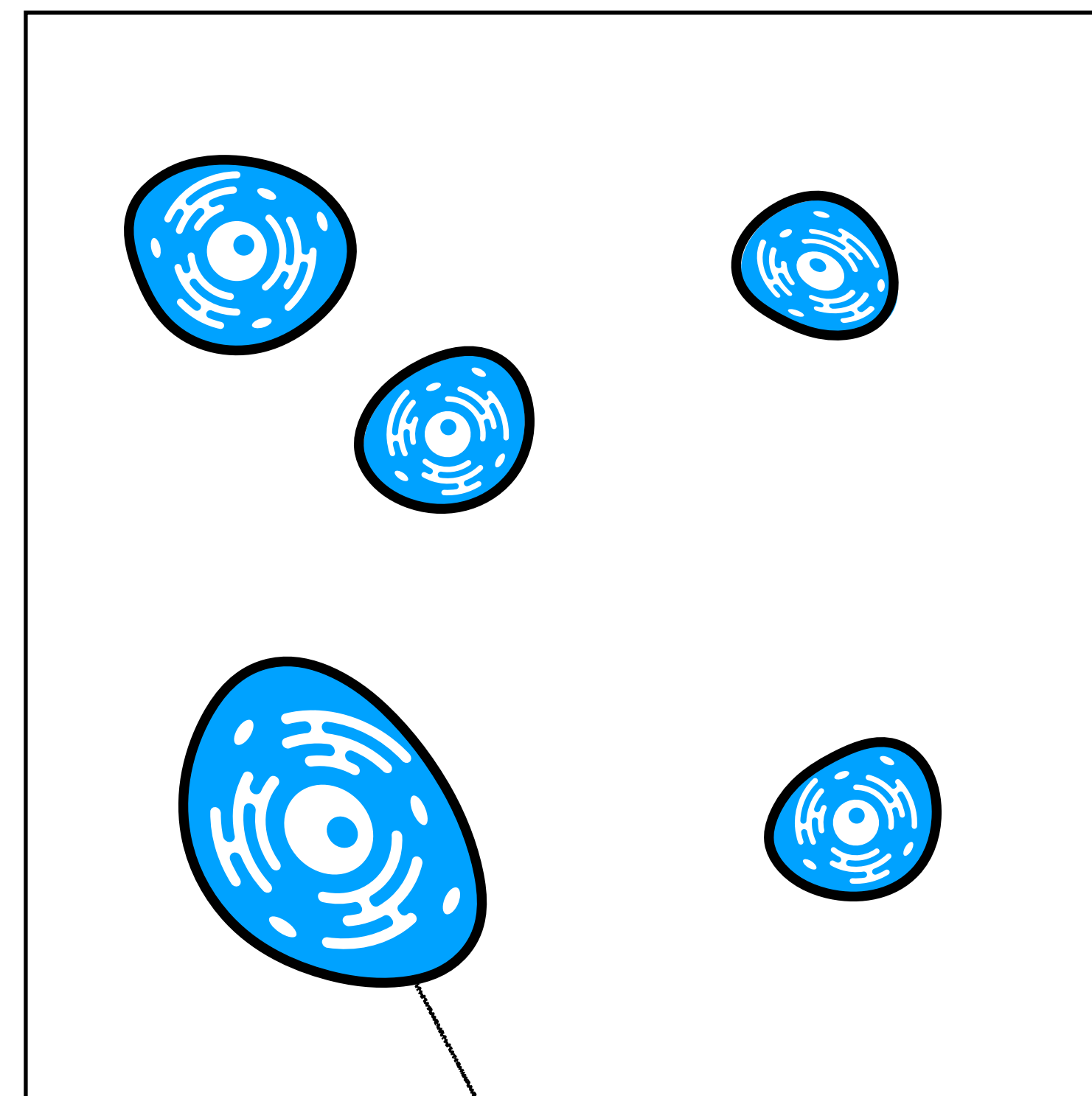
Imaging a Single Well



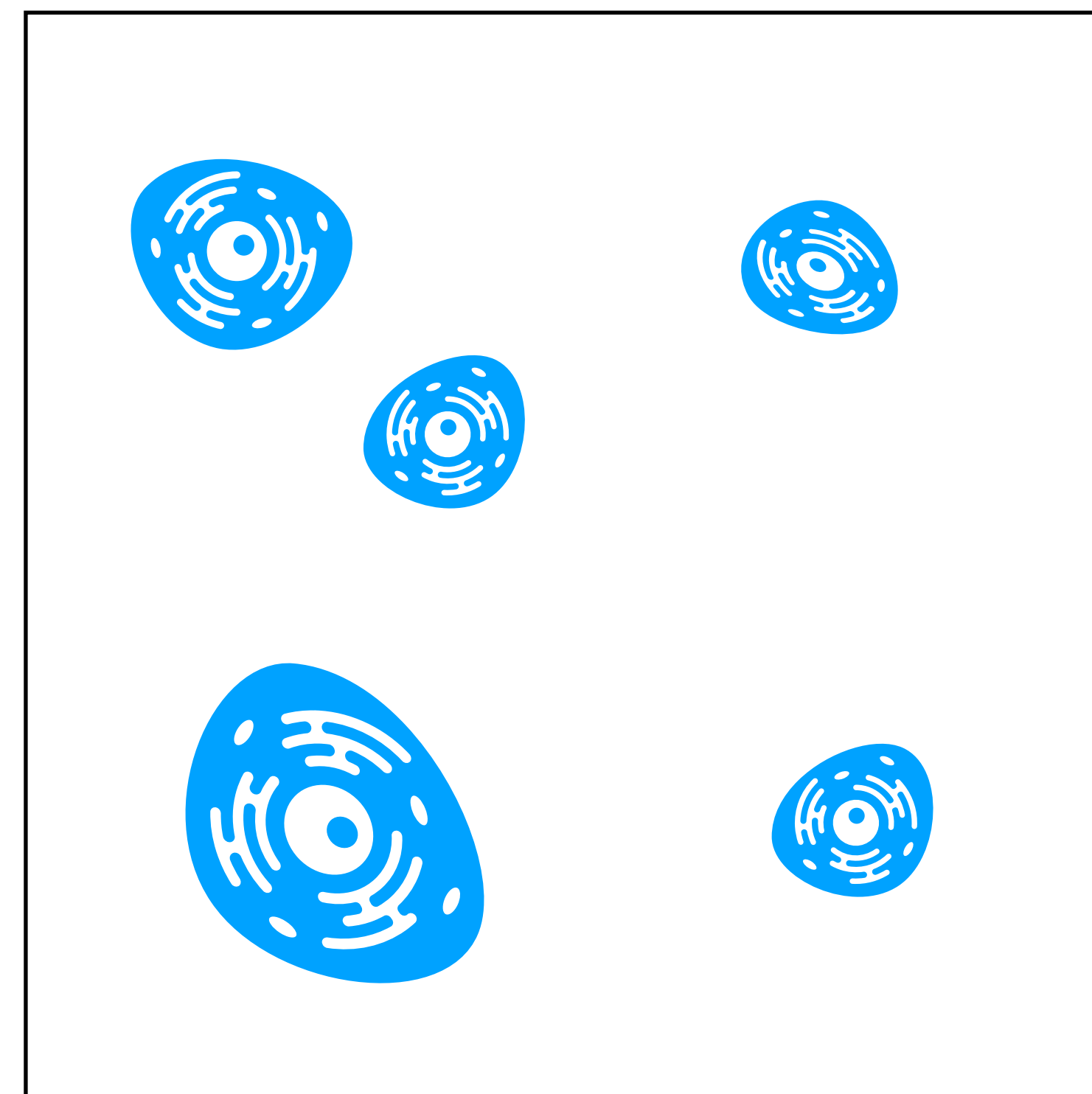
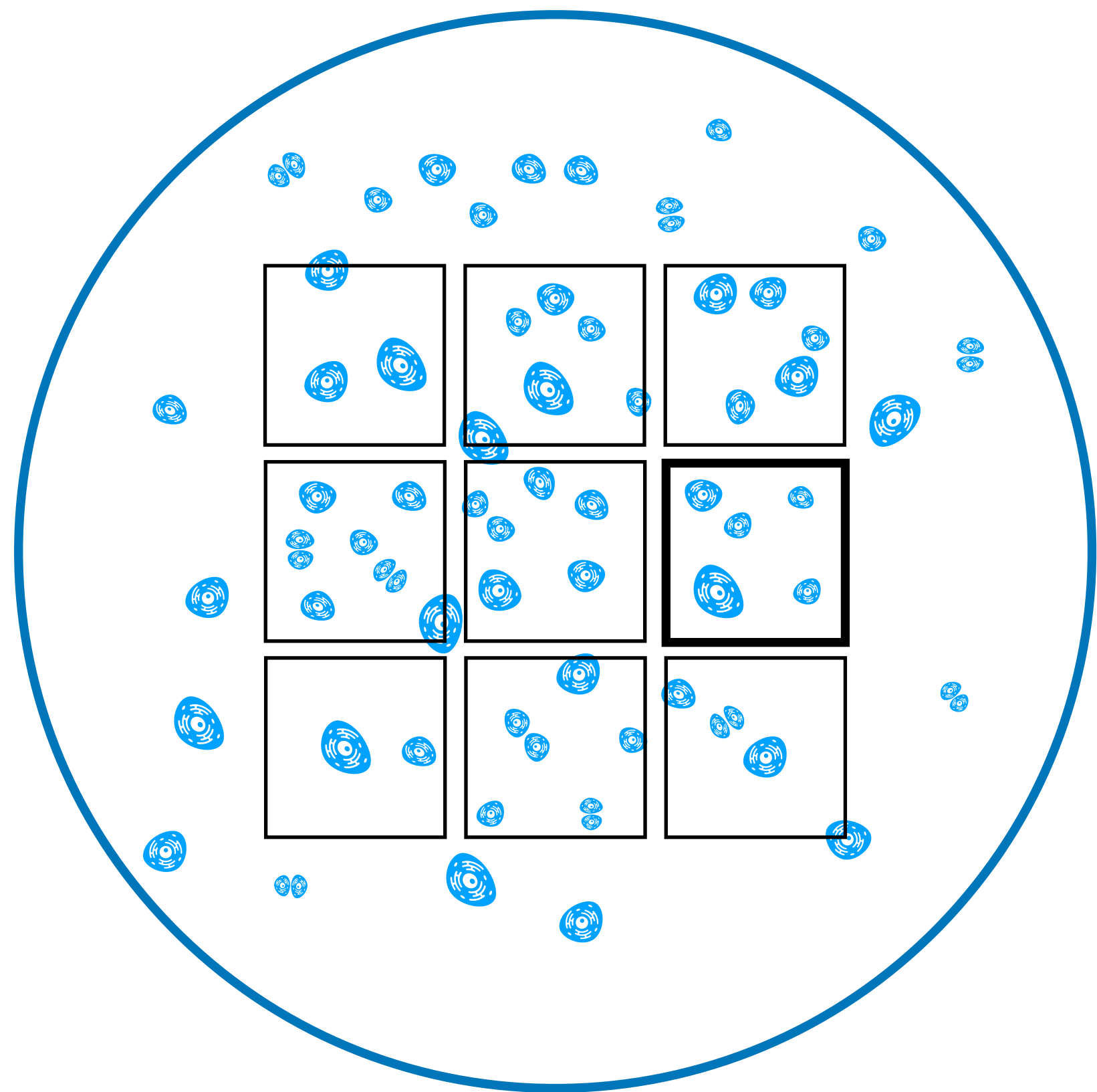
Imaging a Single Well



Imaging a Single Well

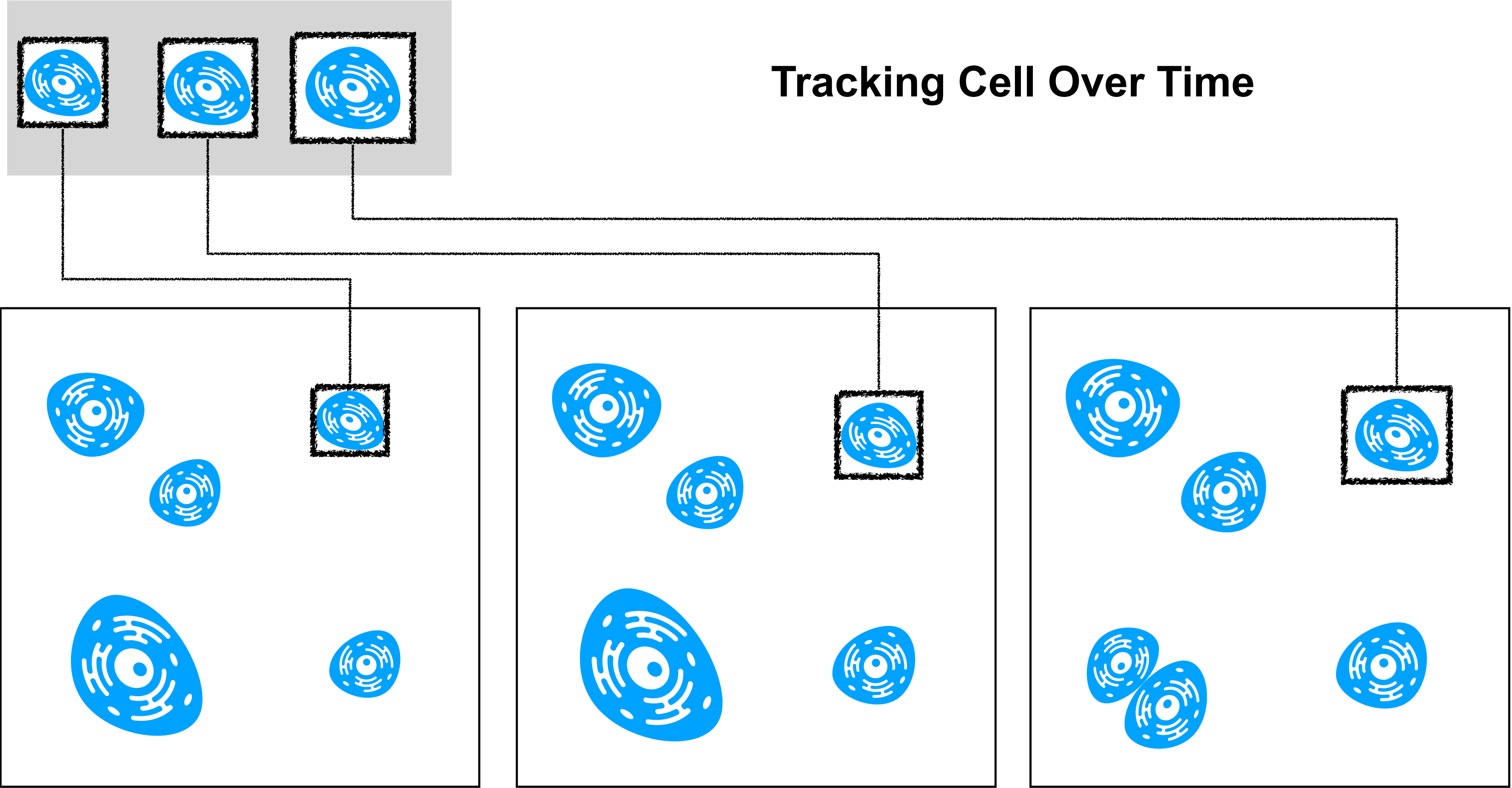


Segmentation

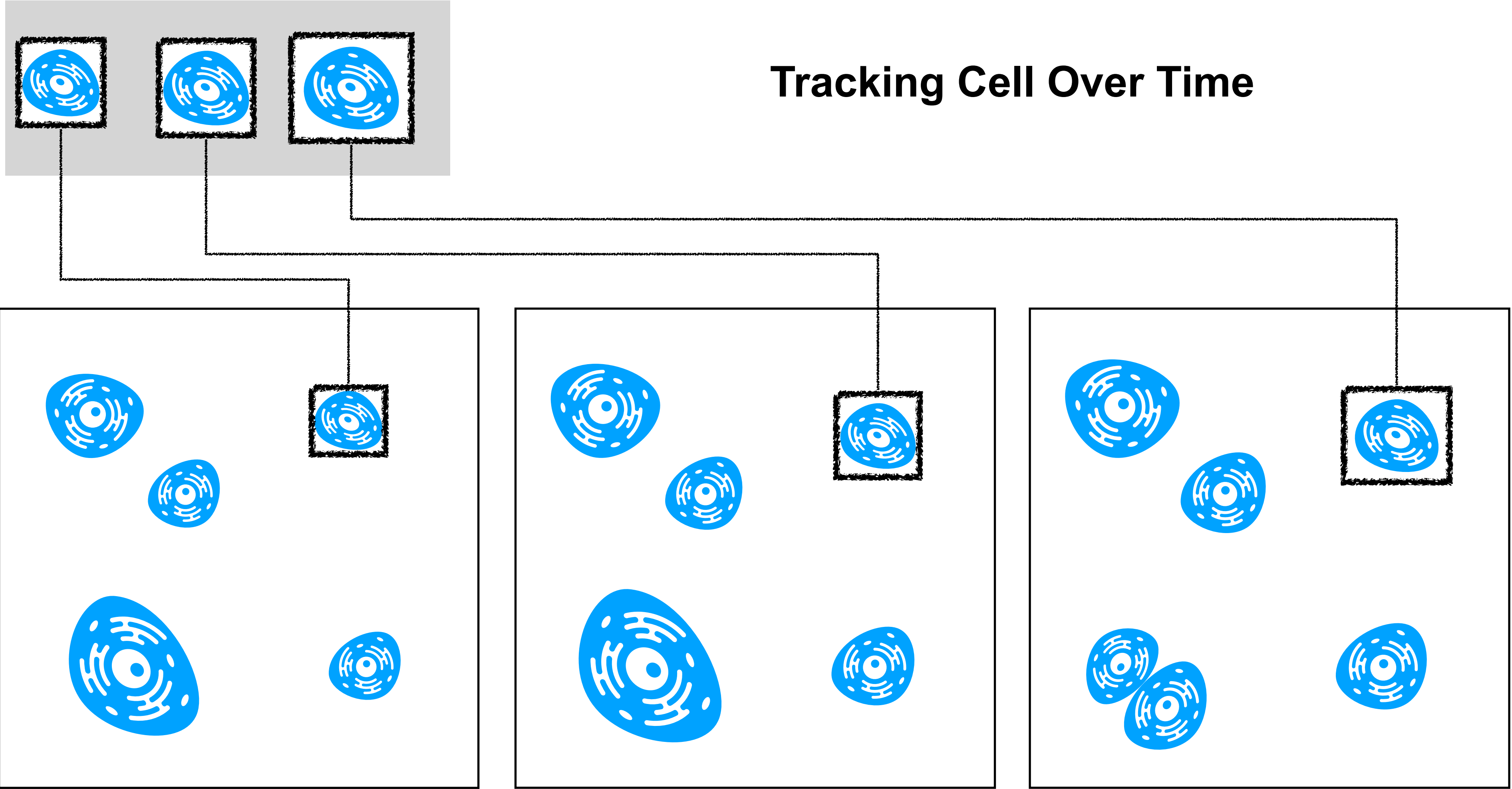


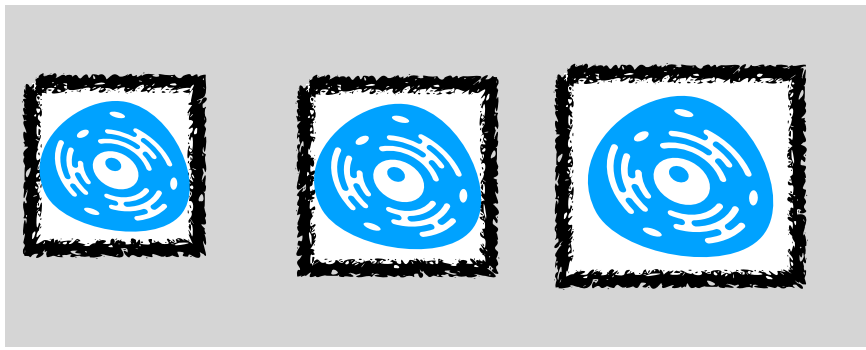
Imaging a Single Well

Tracking Cell Over Time

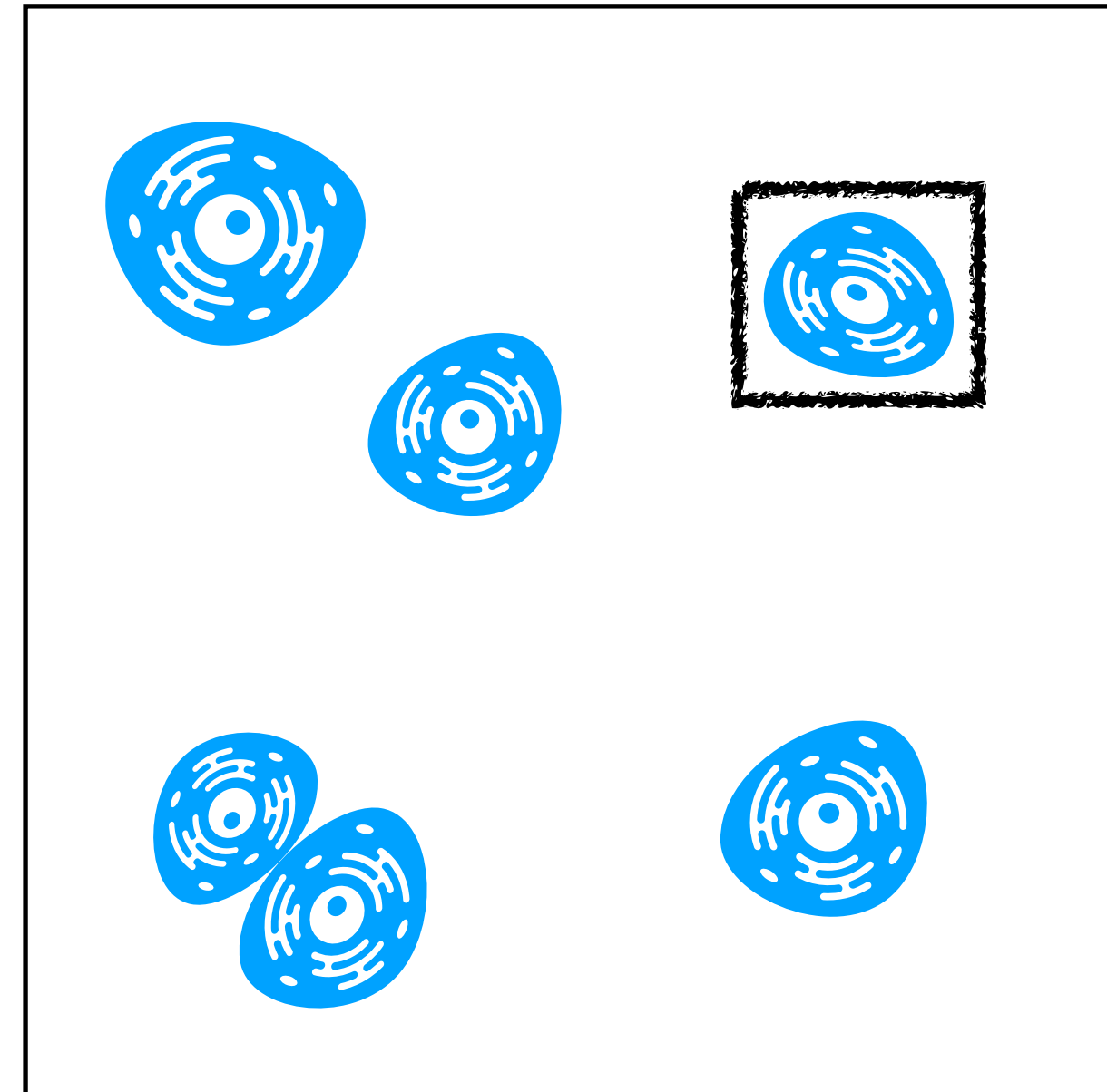
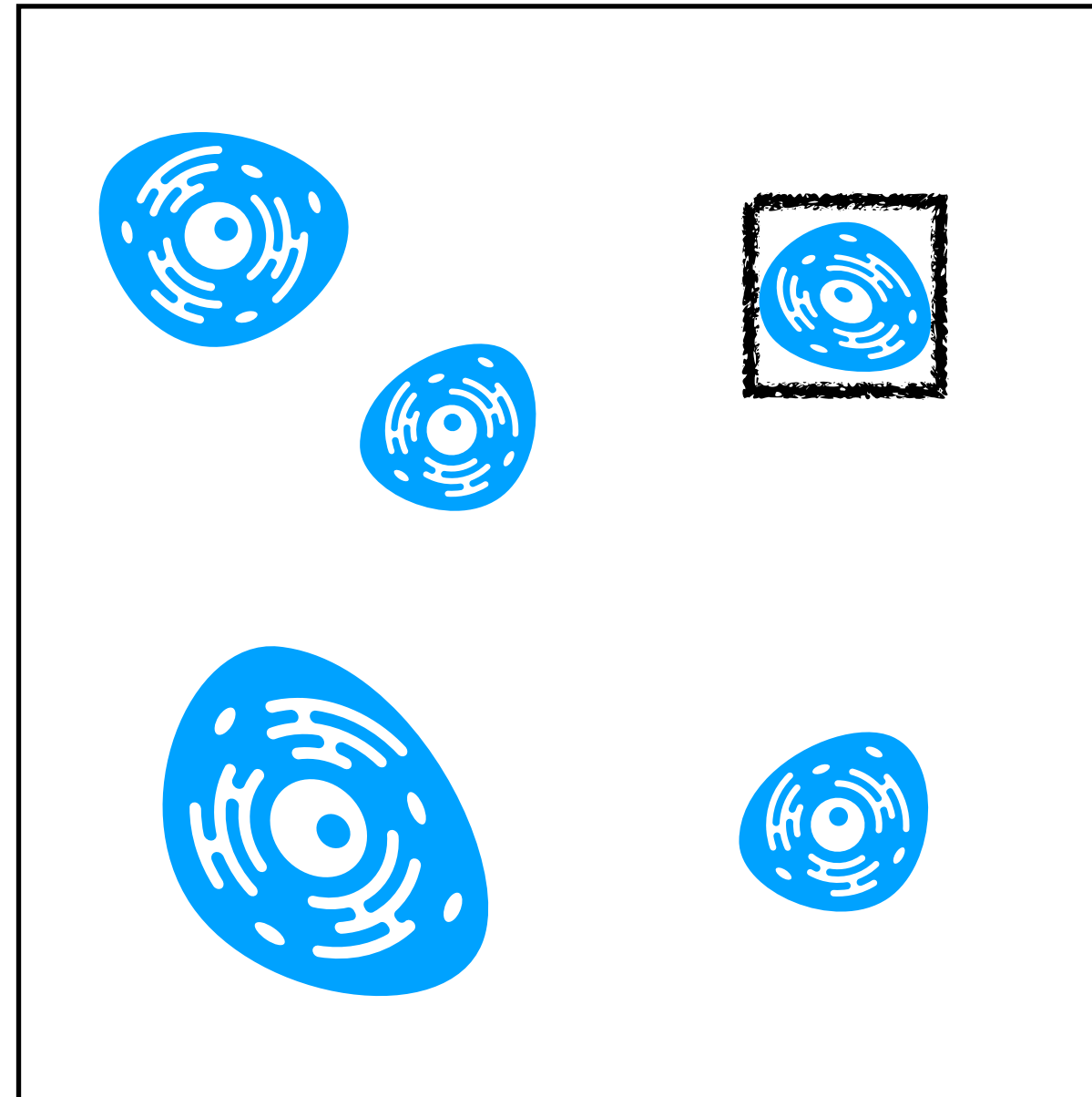
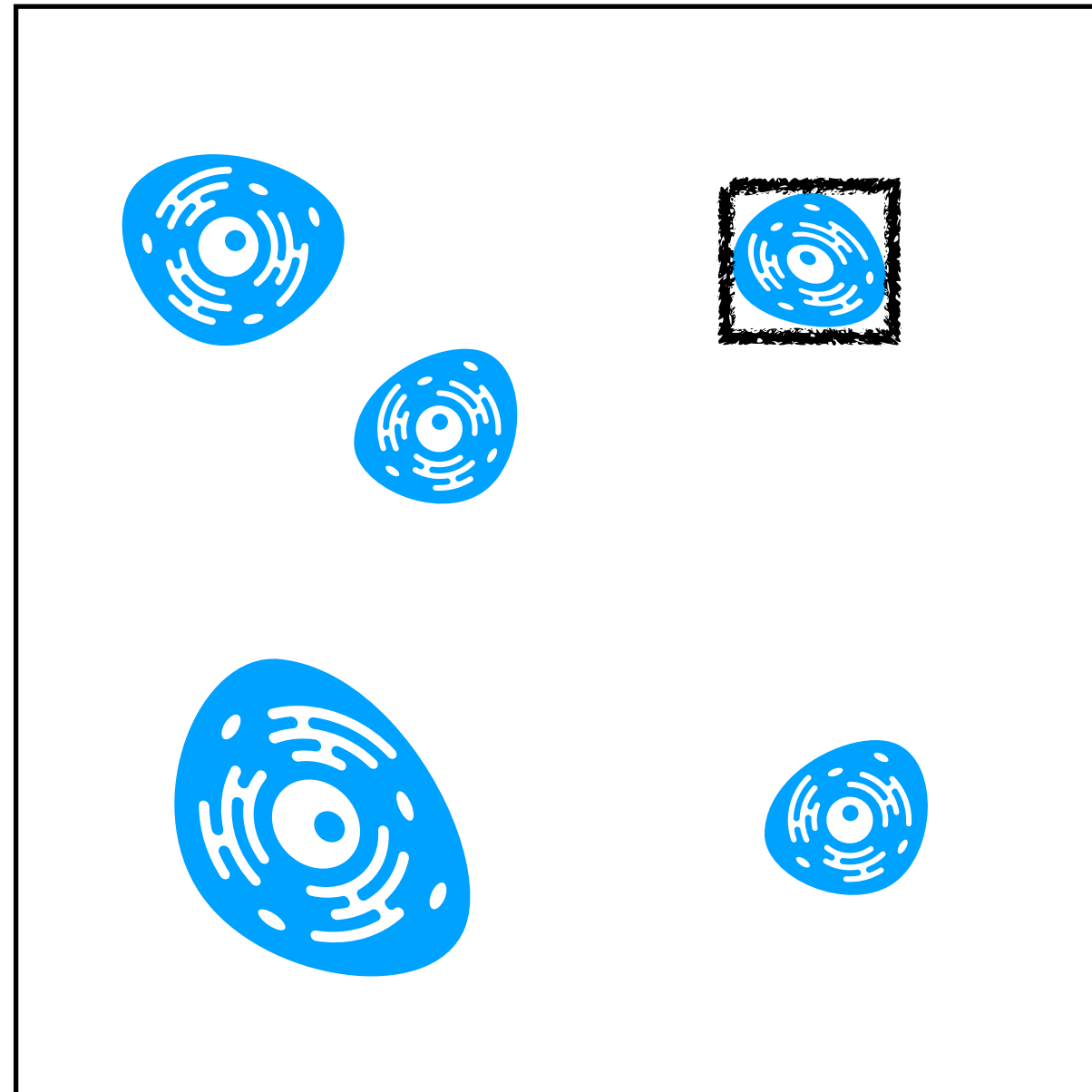


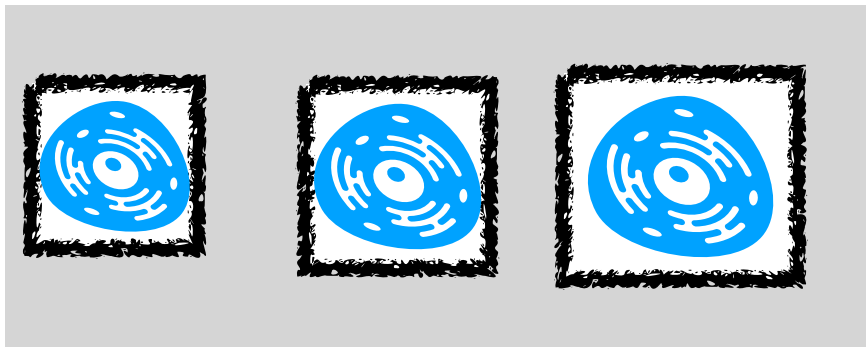
Tracking Cell Over Time



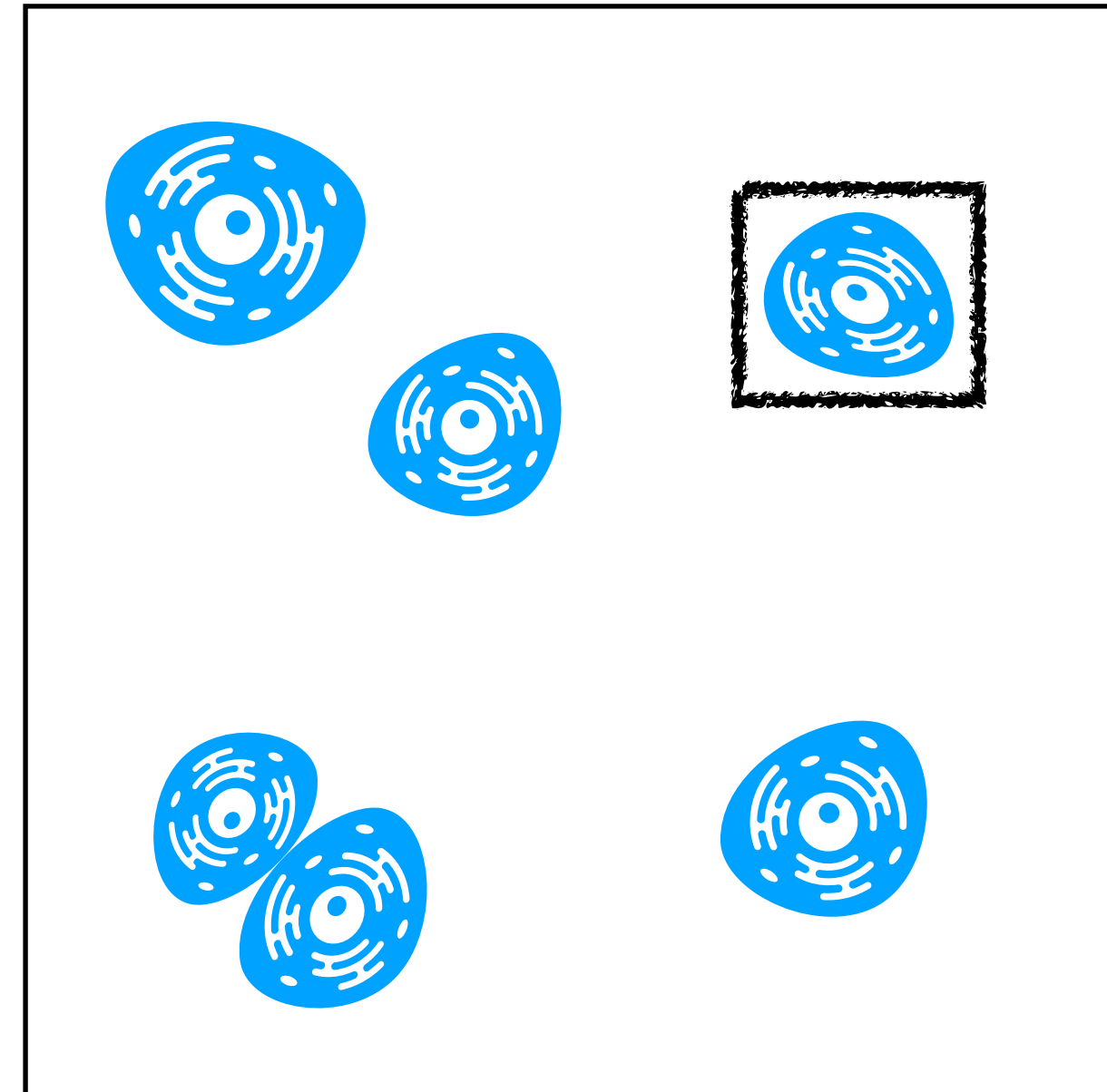
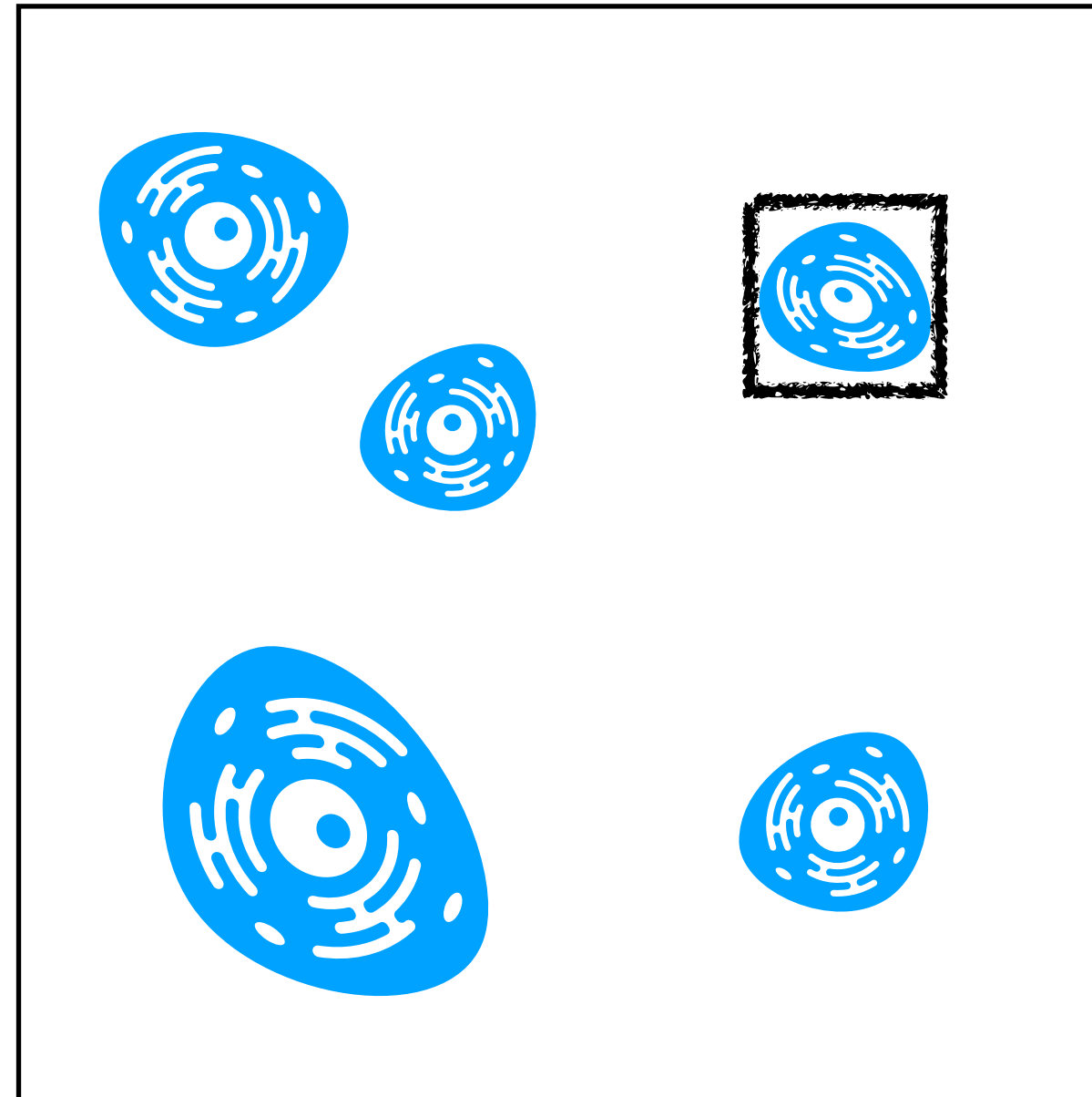
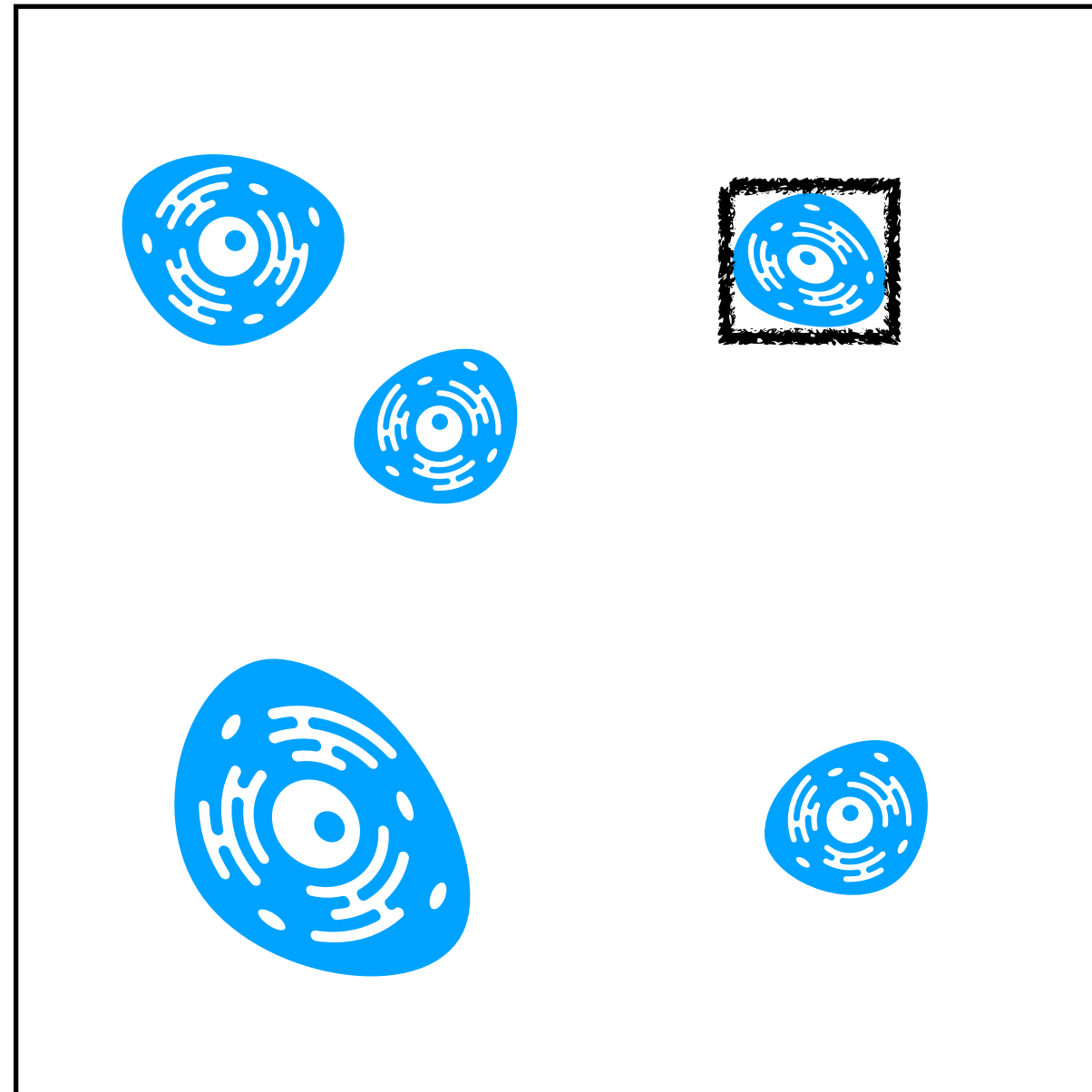


Tracking Cell Over Time

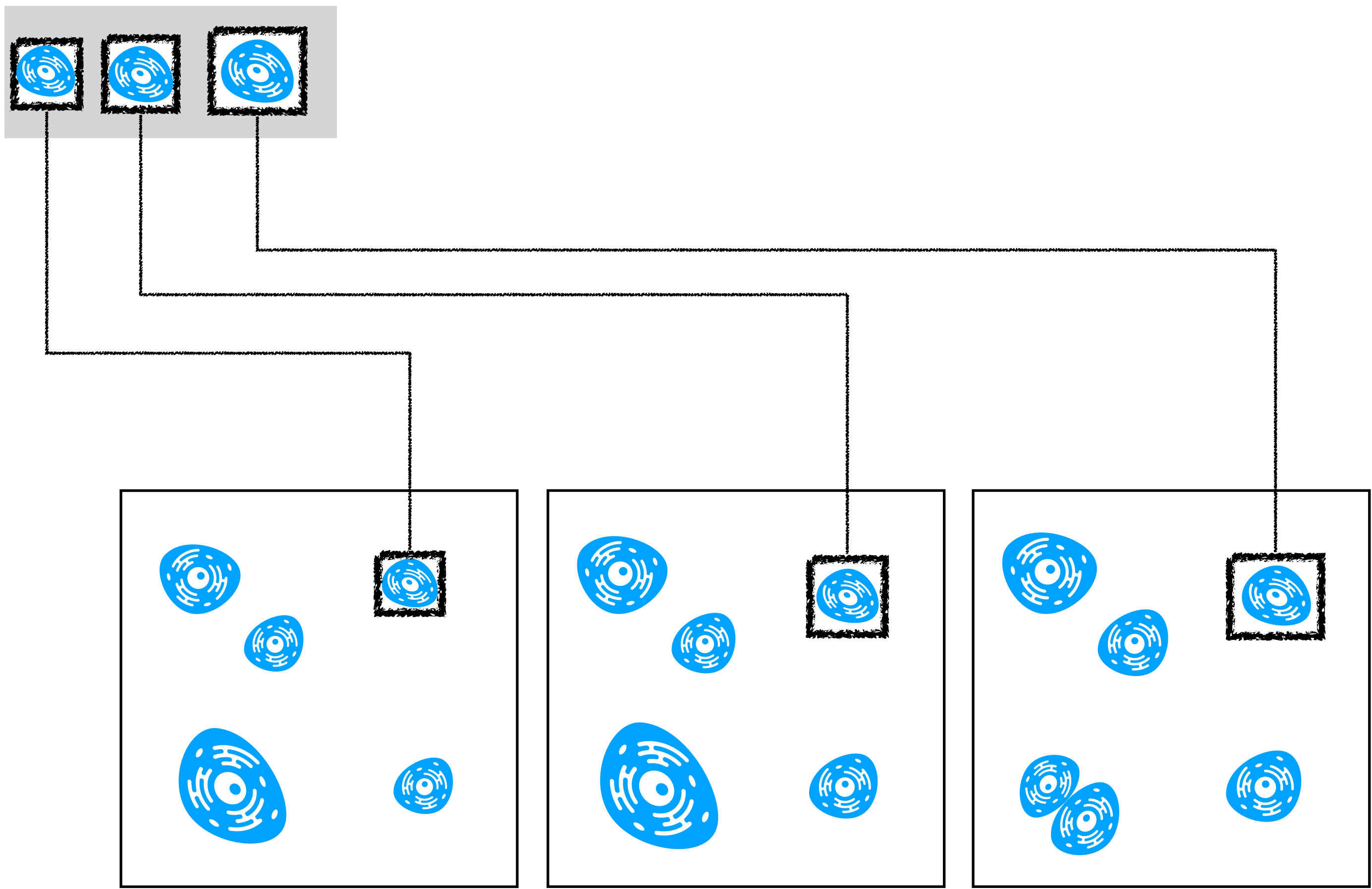




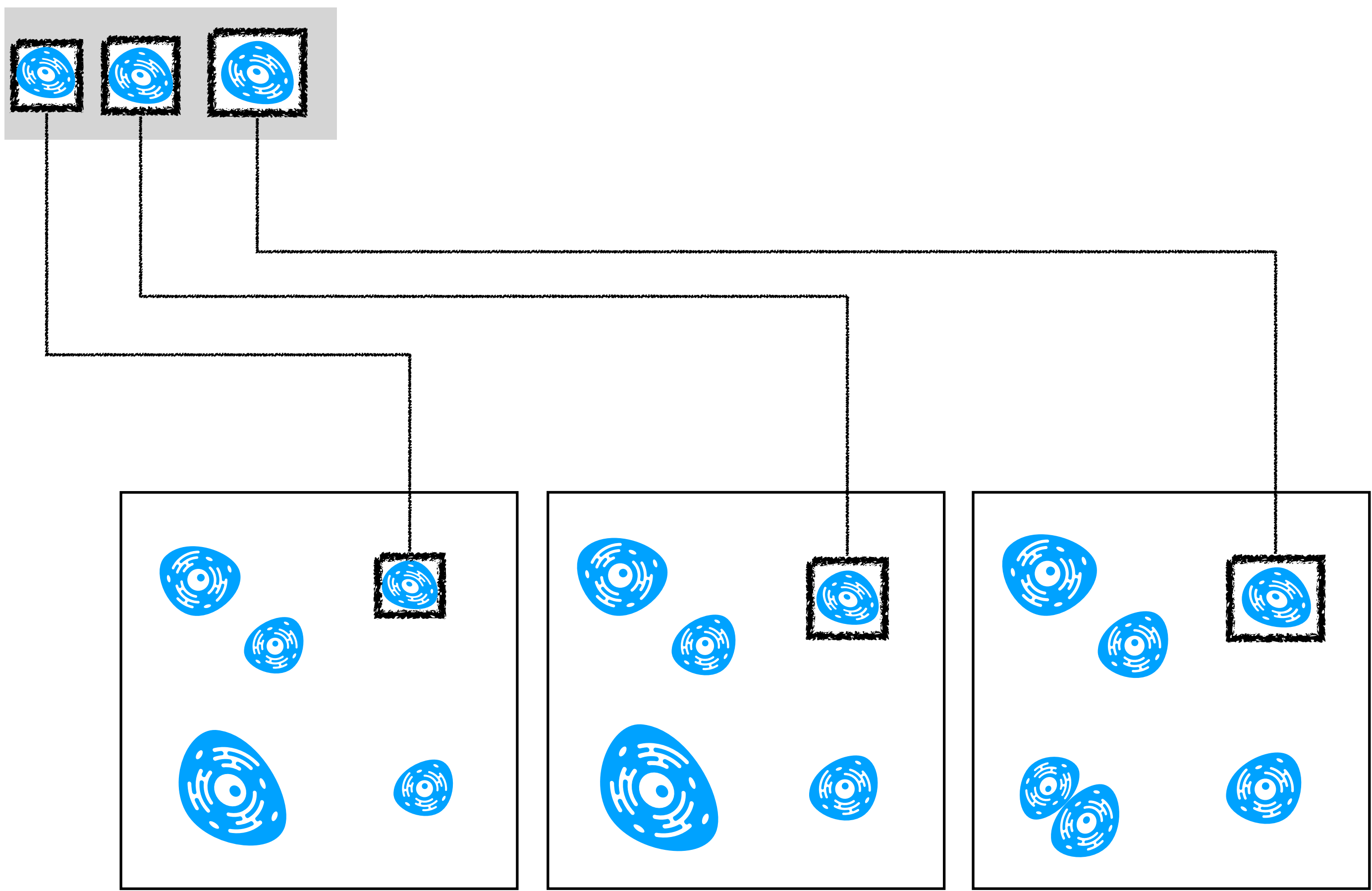
Tracking Cell Over Time



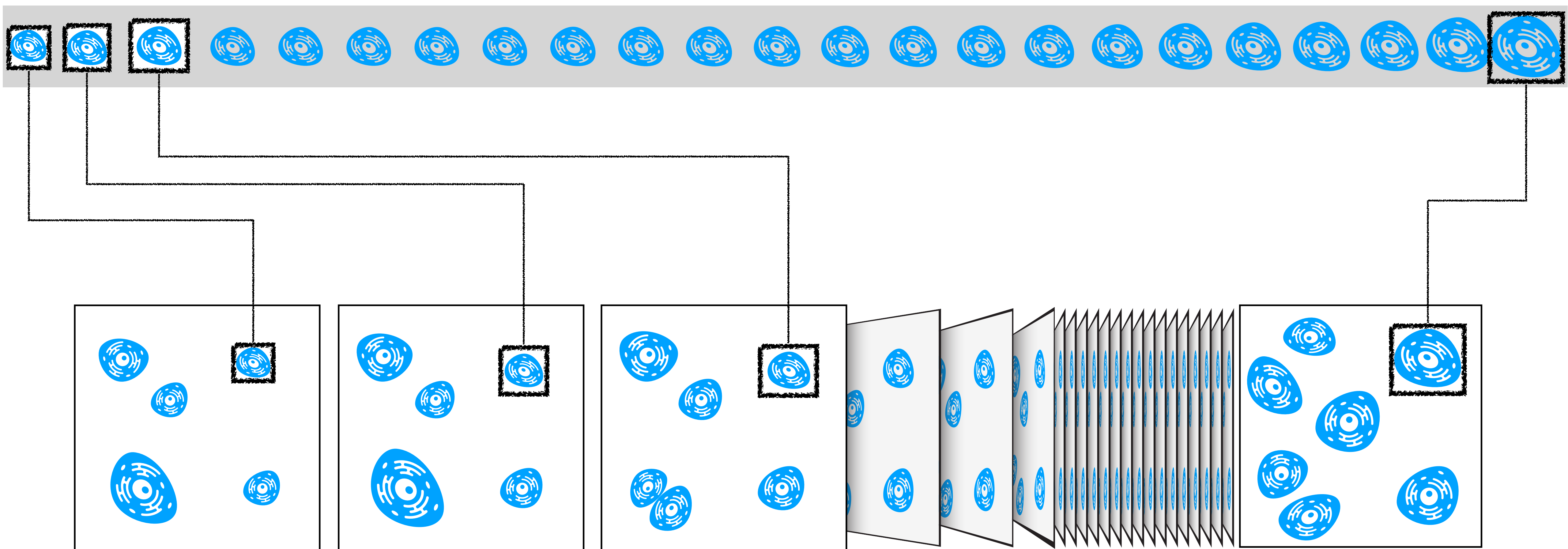
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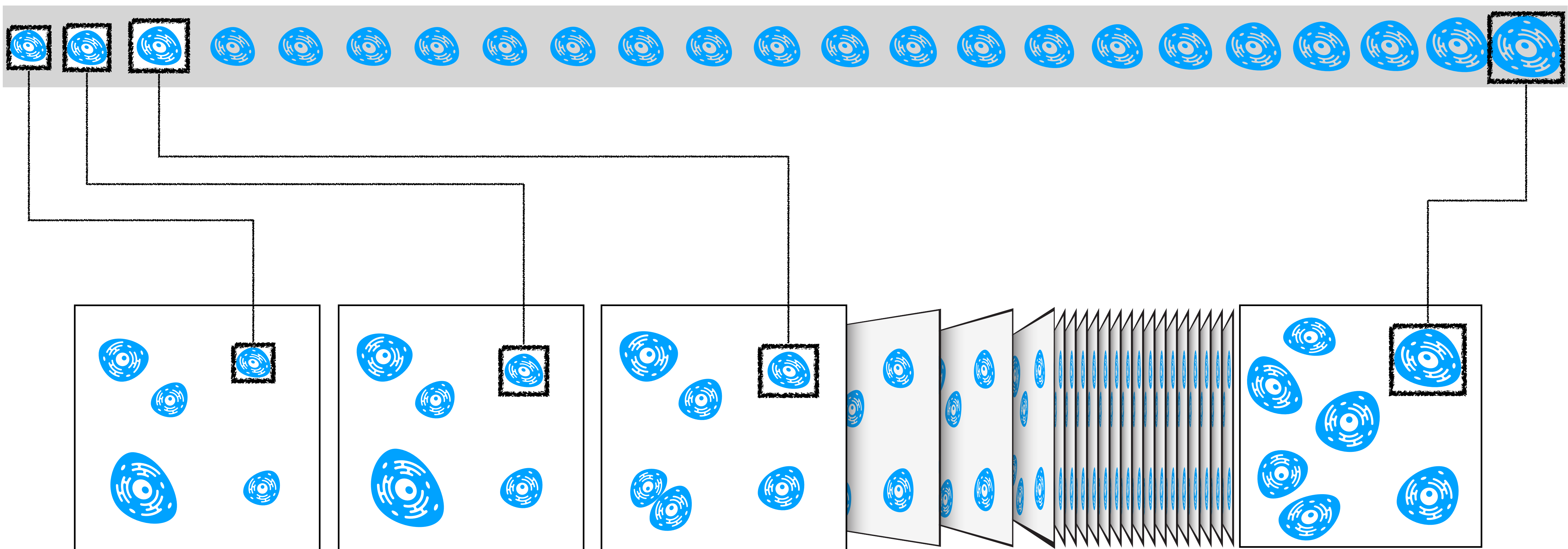
Tracking Cell Over Time



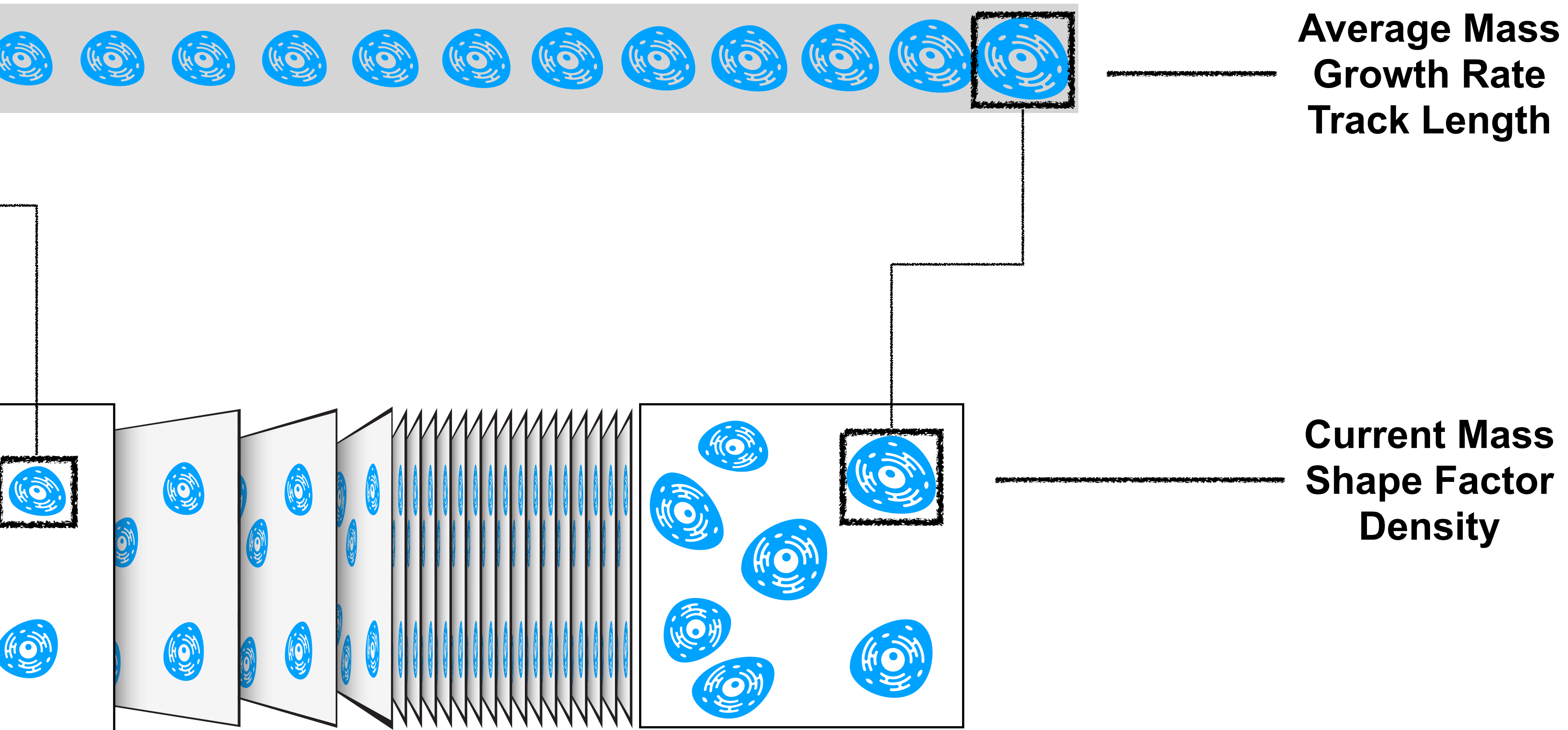
Tracking Cell Over Time



Tracking Cell Over Time



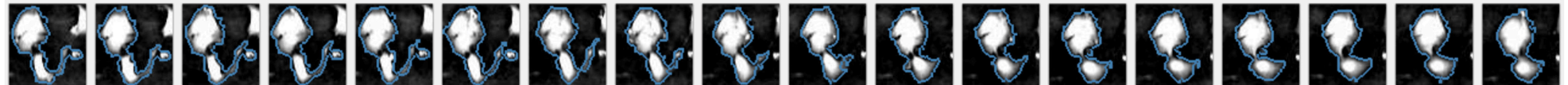
Cell and Track Attributes

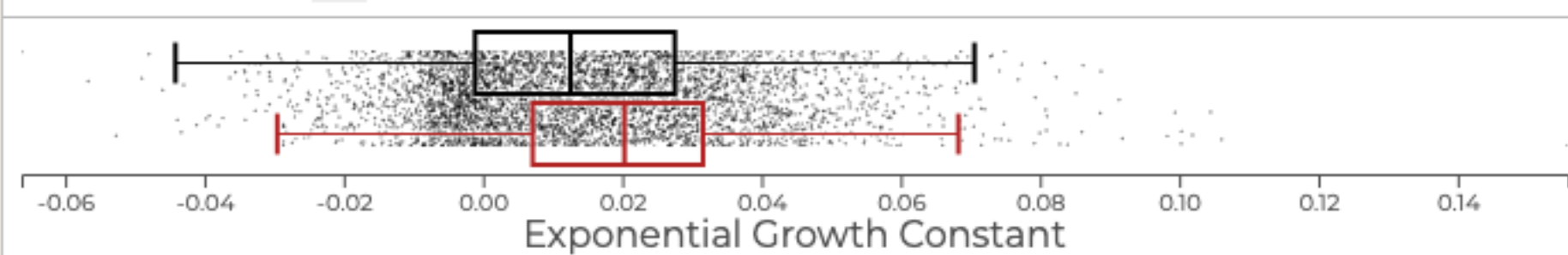
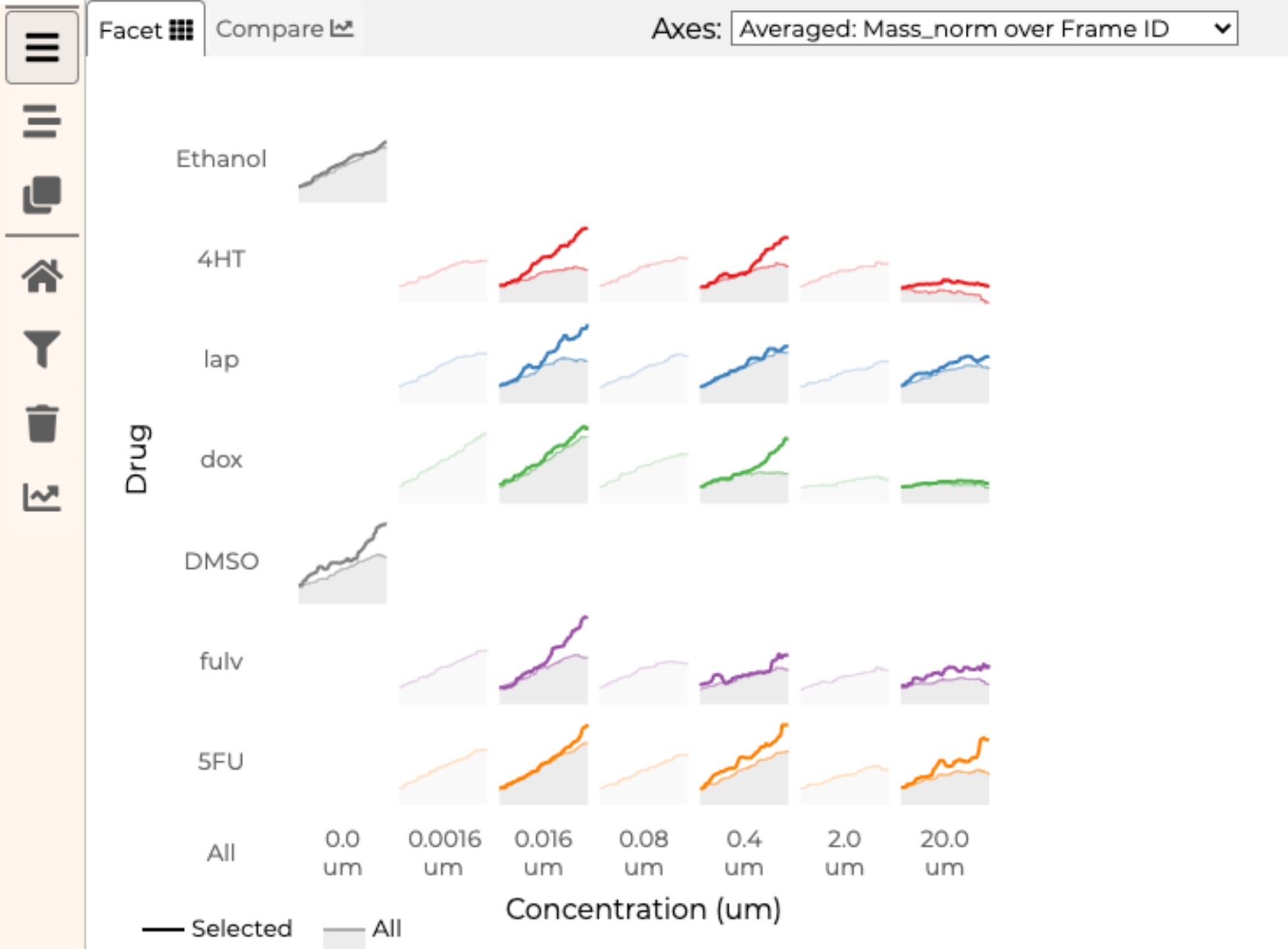


Exemplars

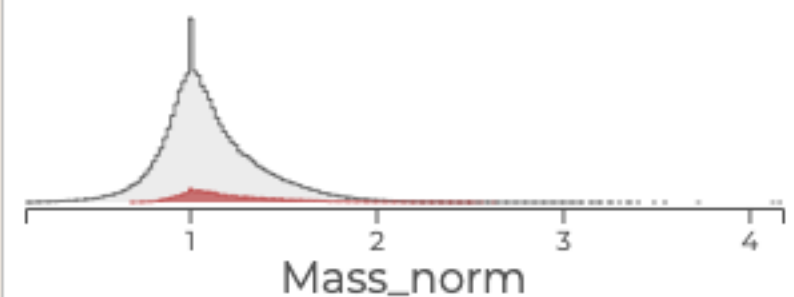
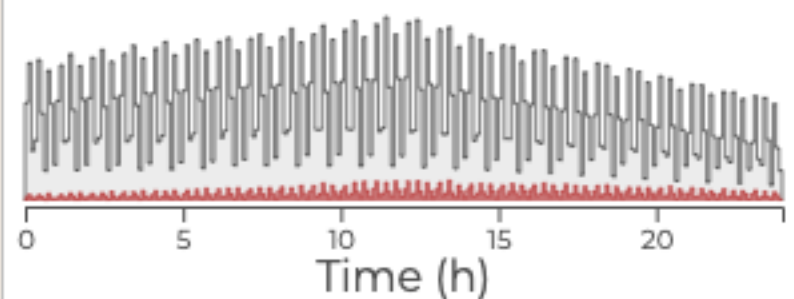
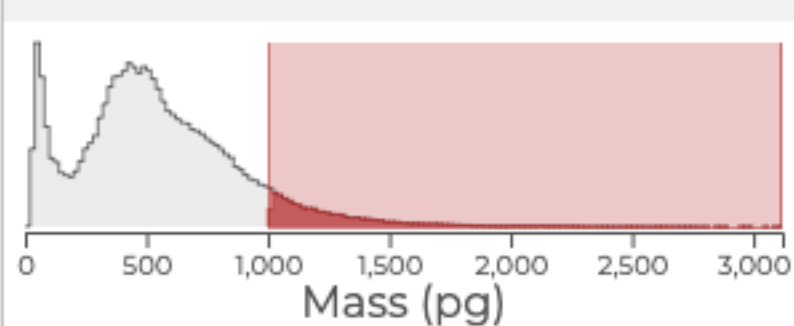
Exemplars

Representative data points that include important contextual information that cannot be summarized.

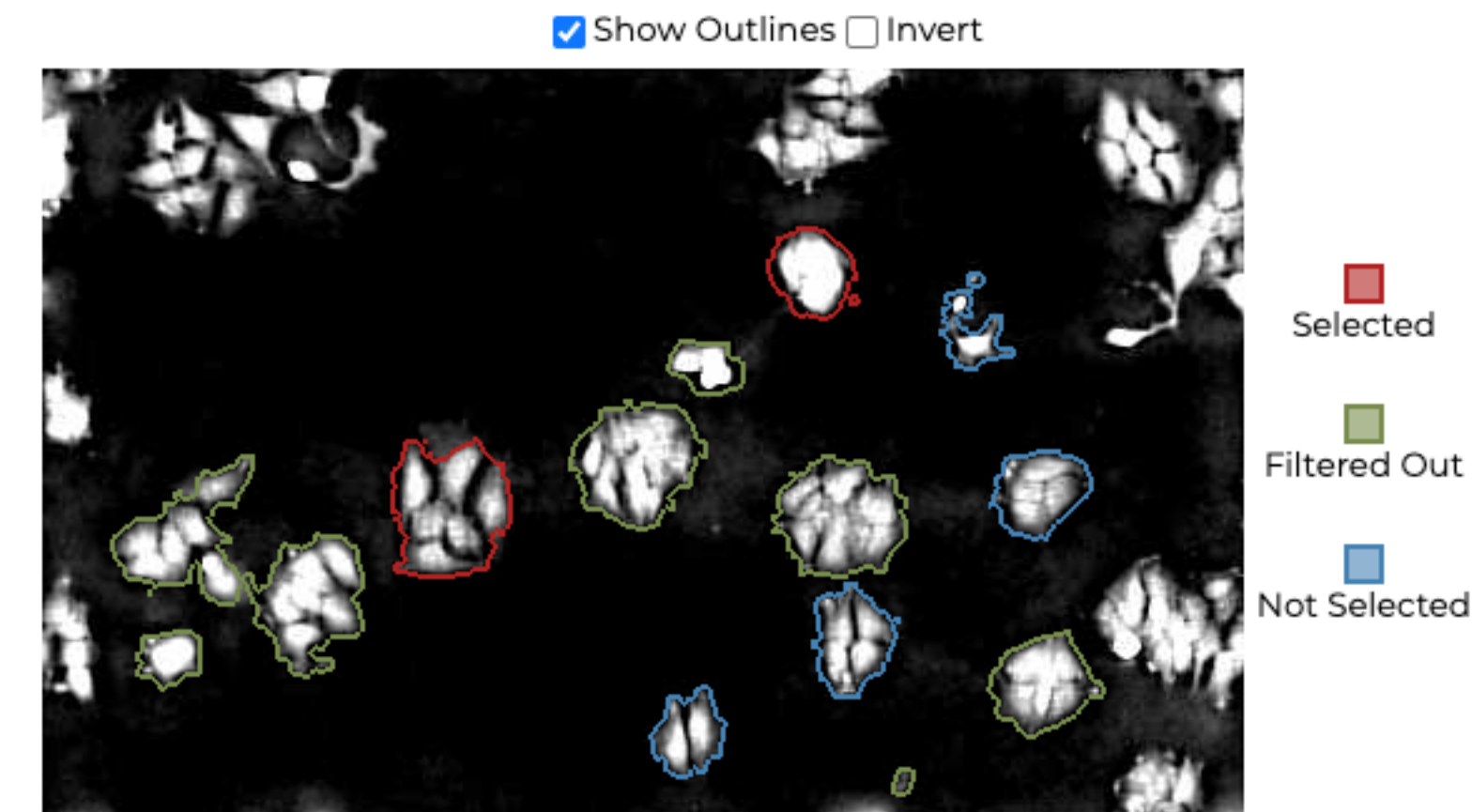
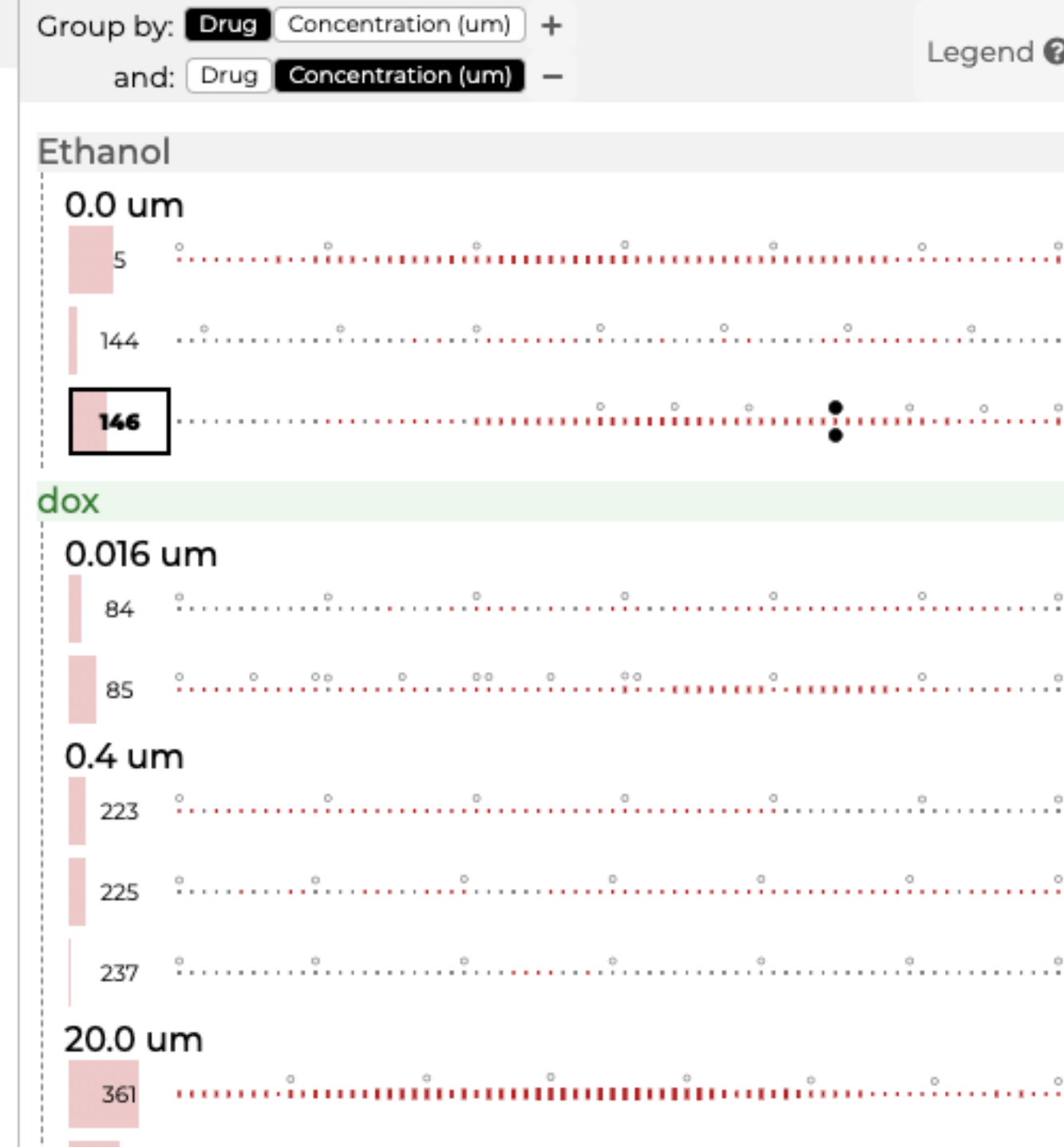
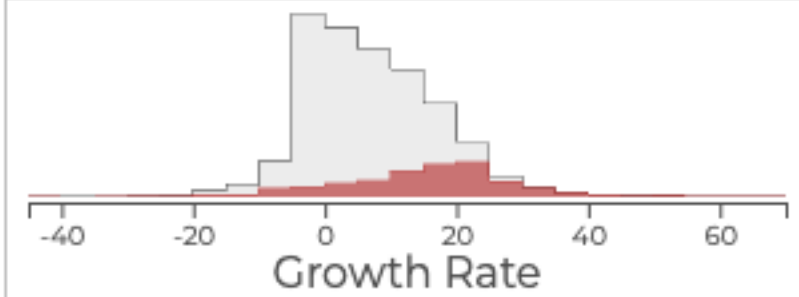
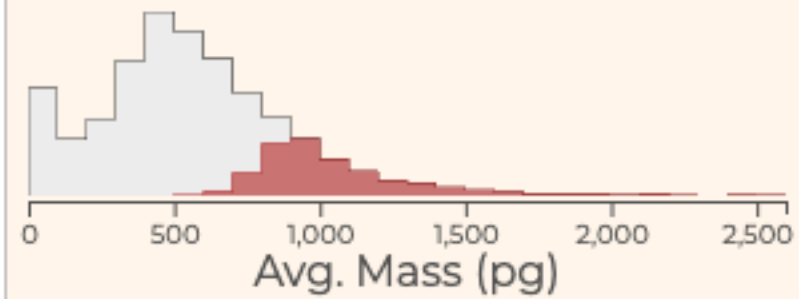
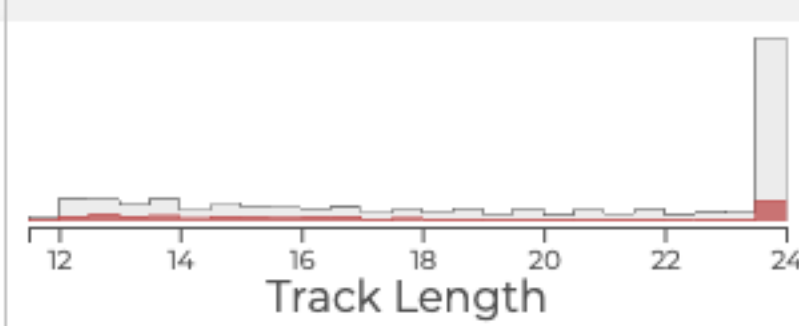




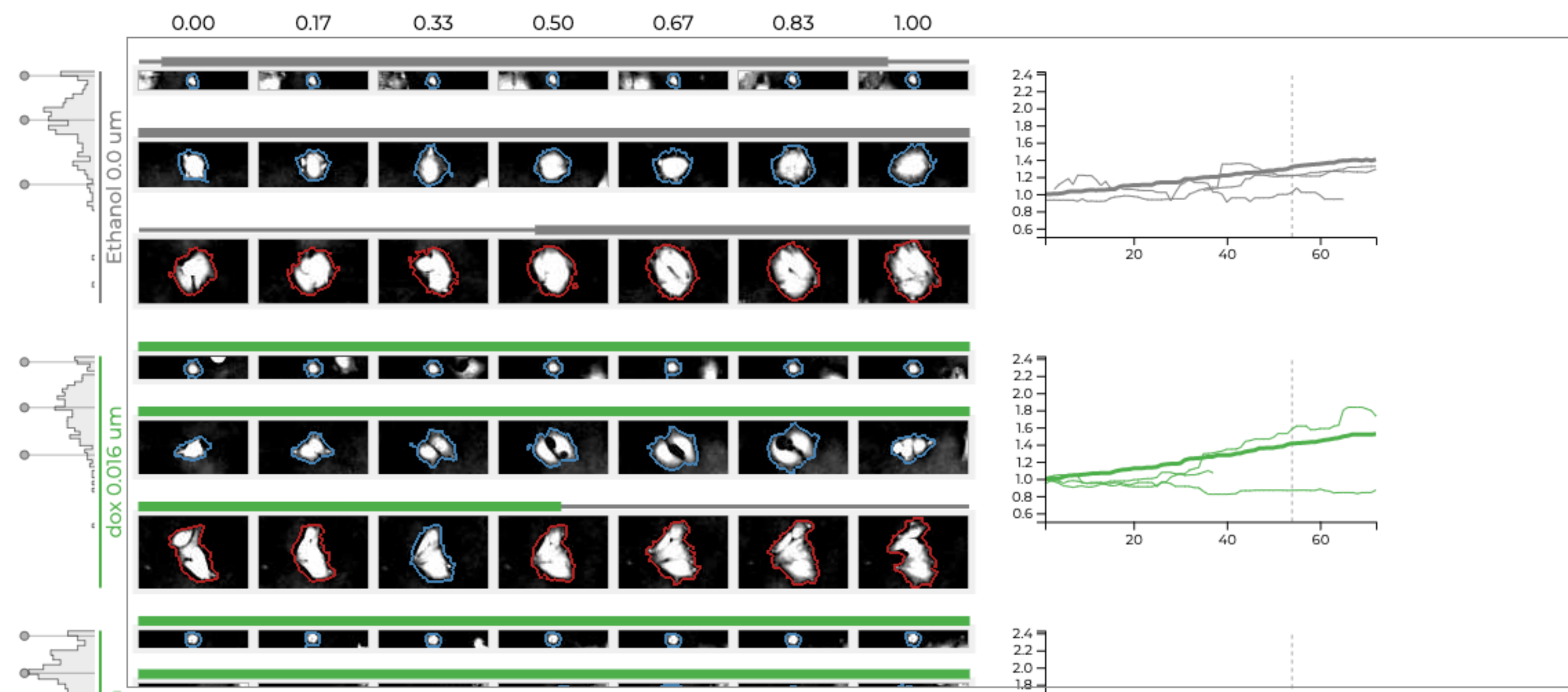
Cell-Level Attributes

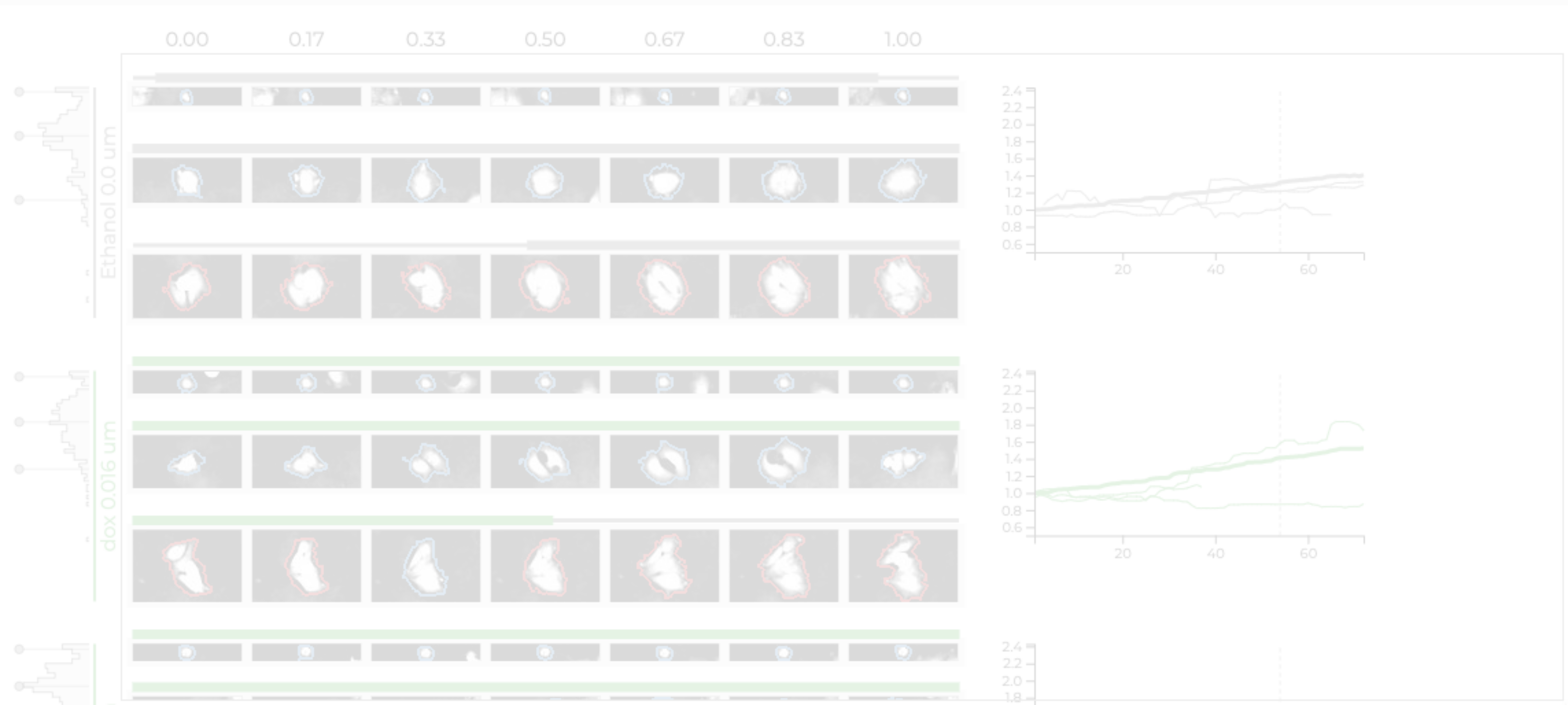
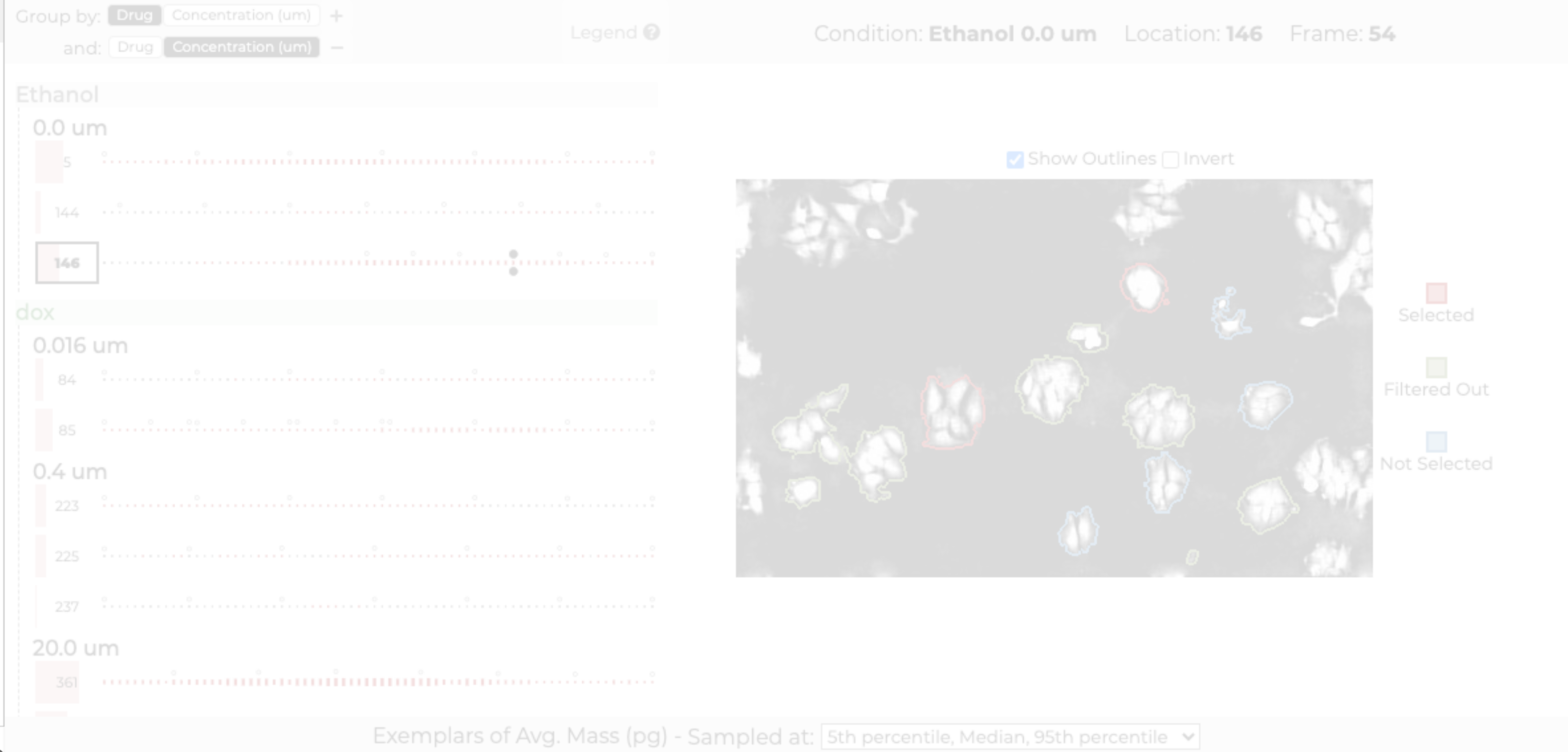
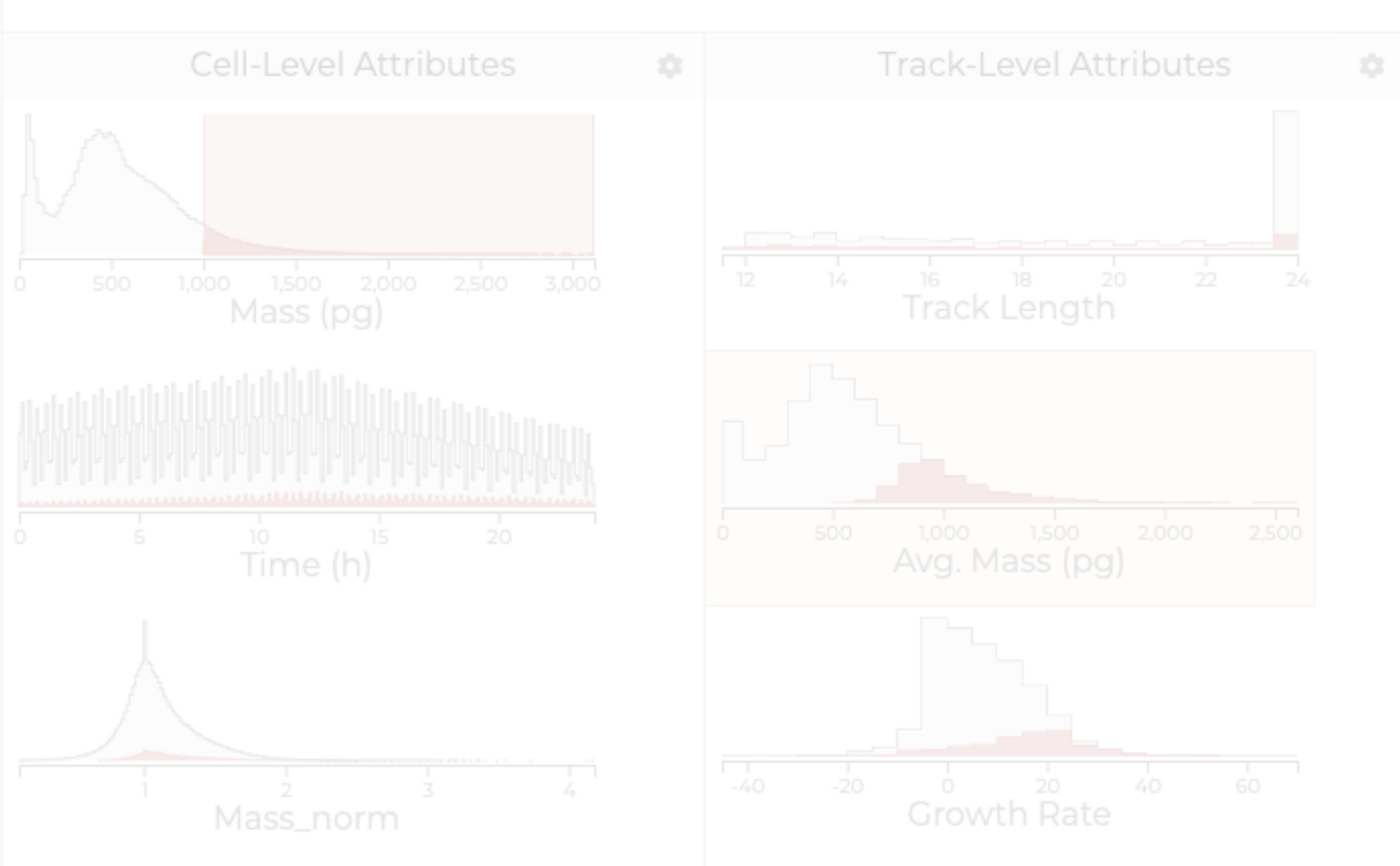
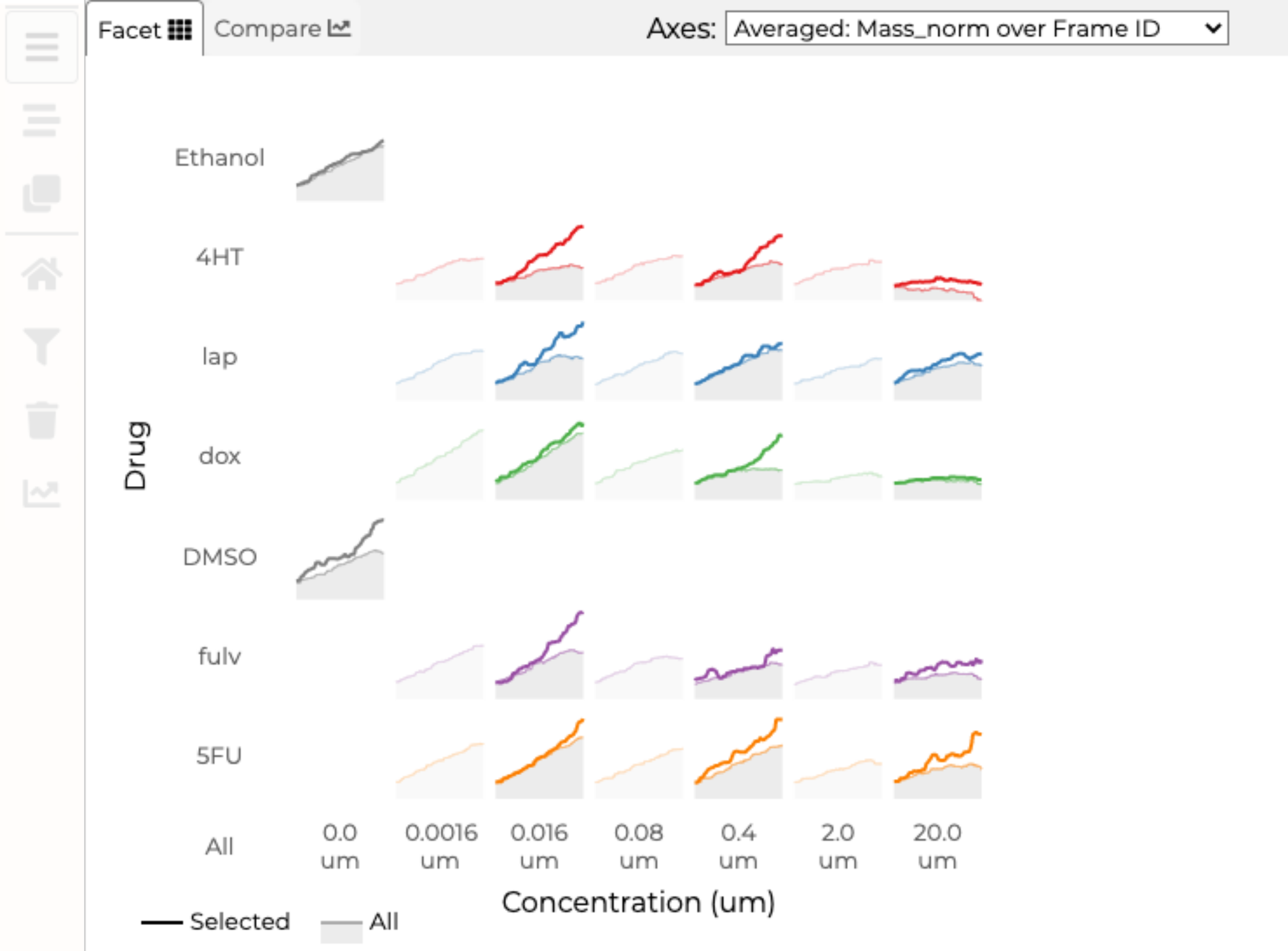


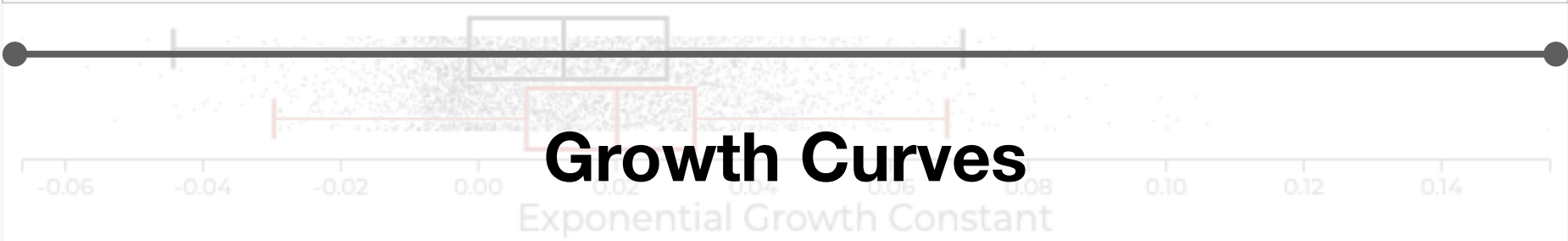
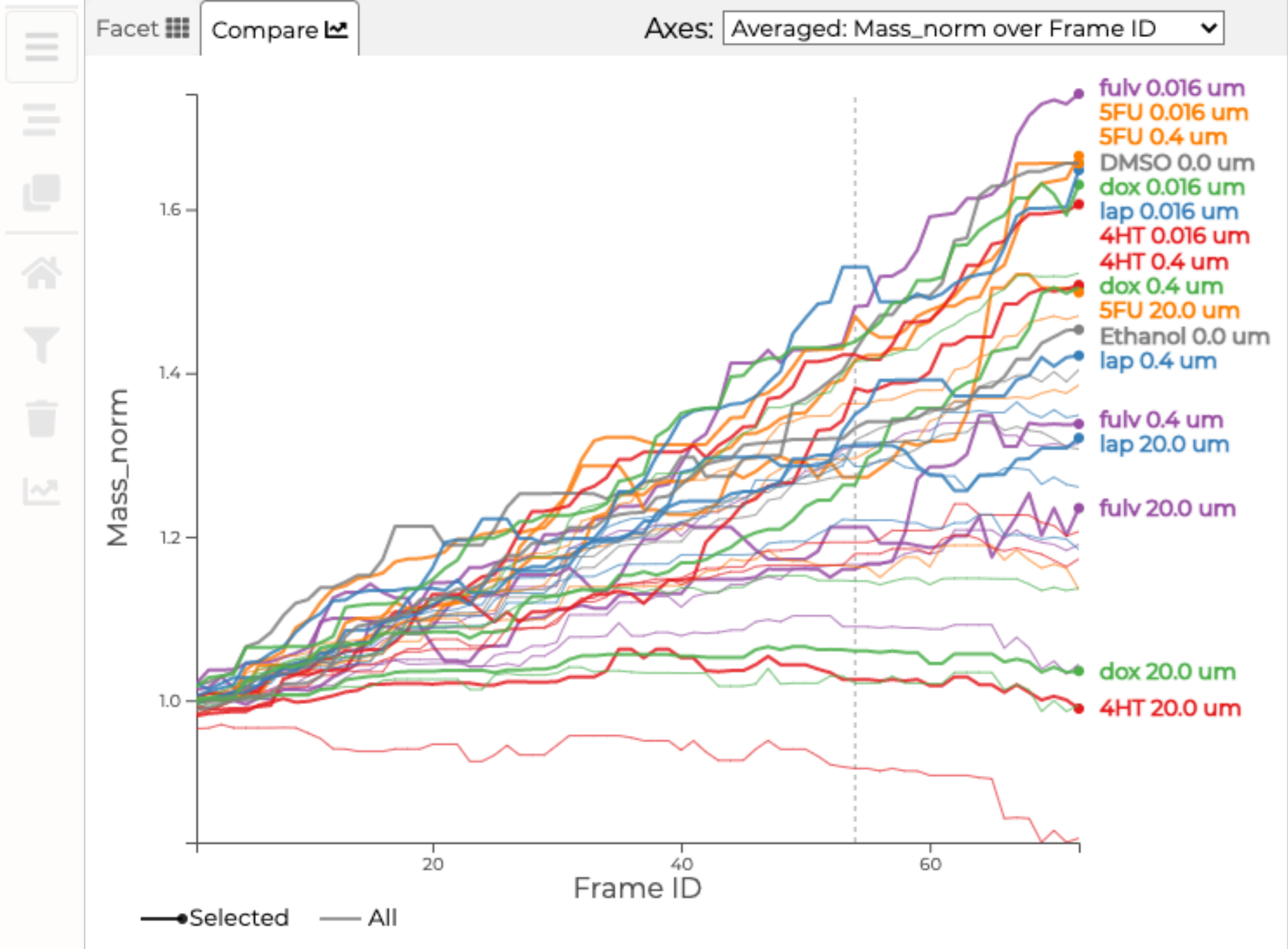
Track-Level Attributes



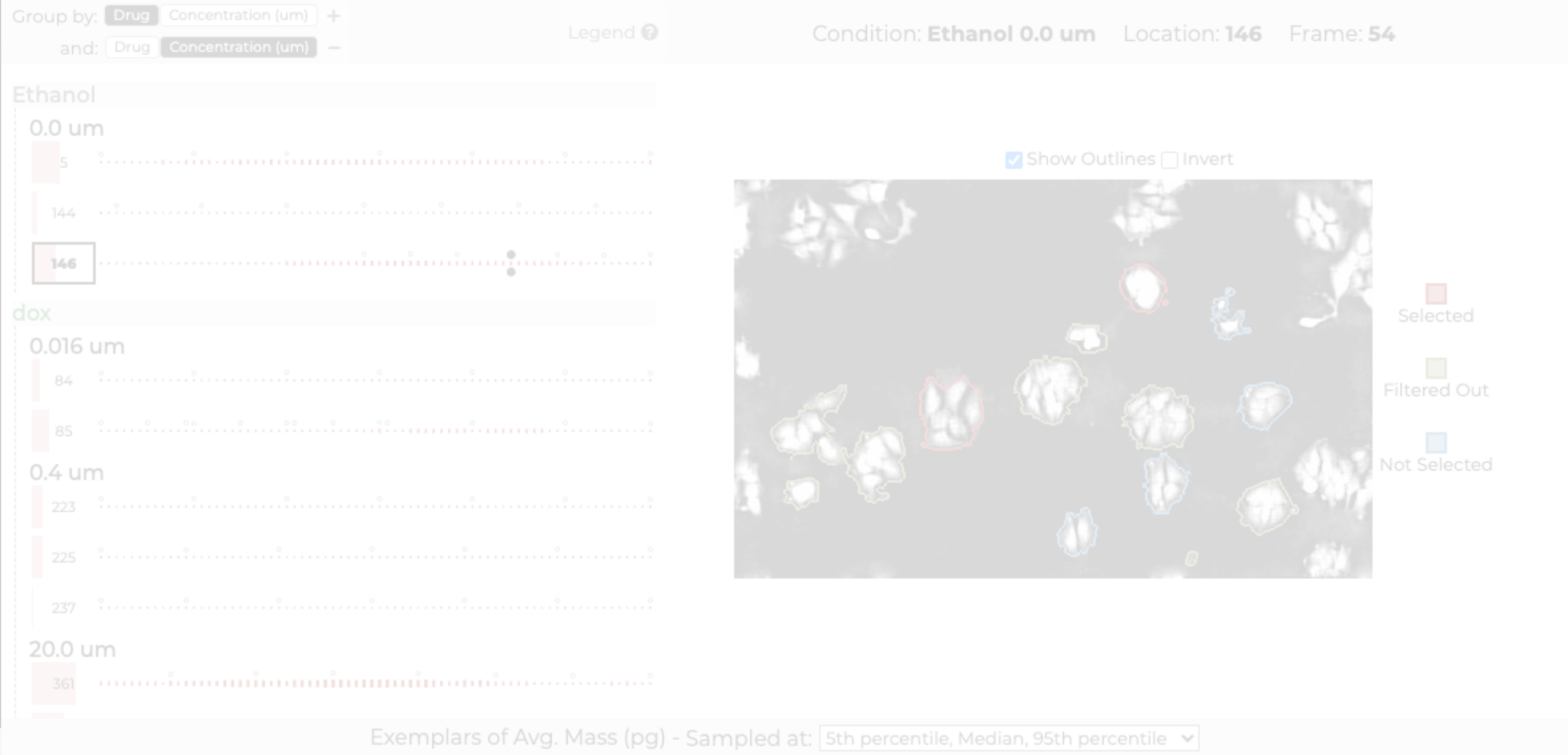
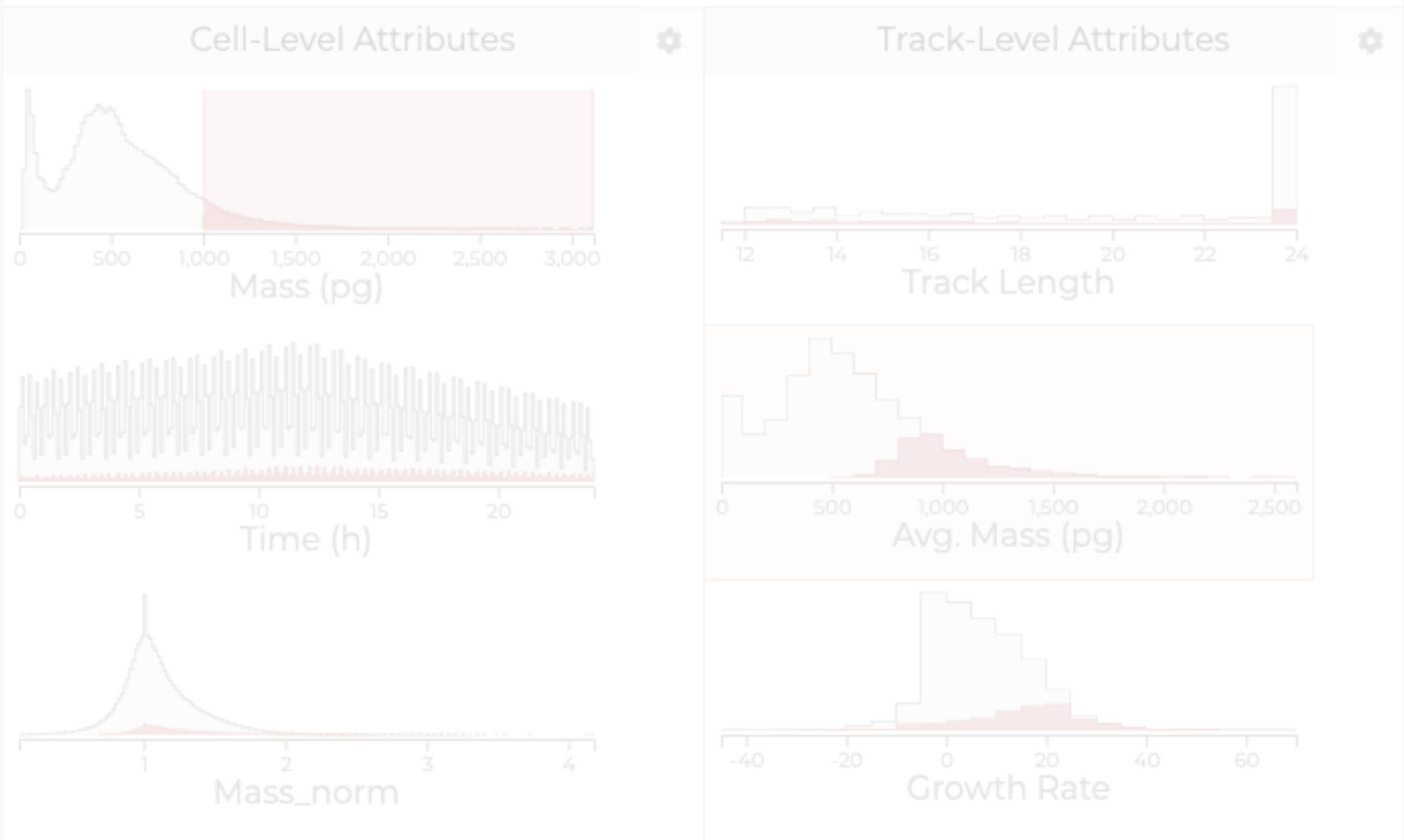
Exemplars of Avg. Mass (pg) - Sampled at: 5th percentile, Median, 95th percentile







Growth Curves



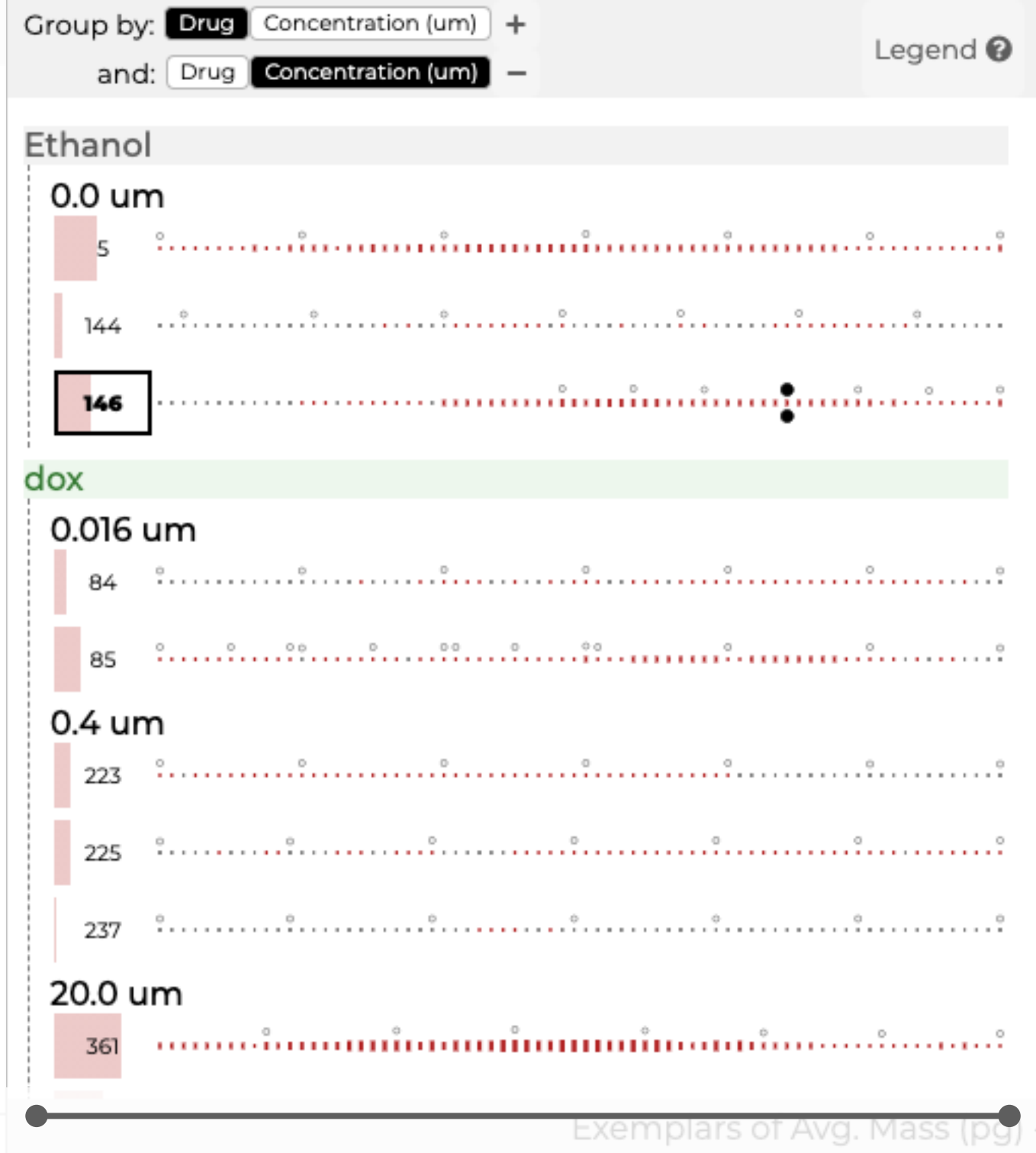
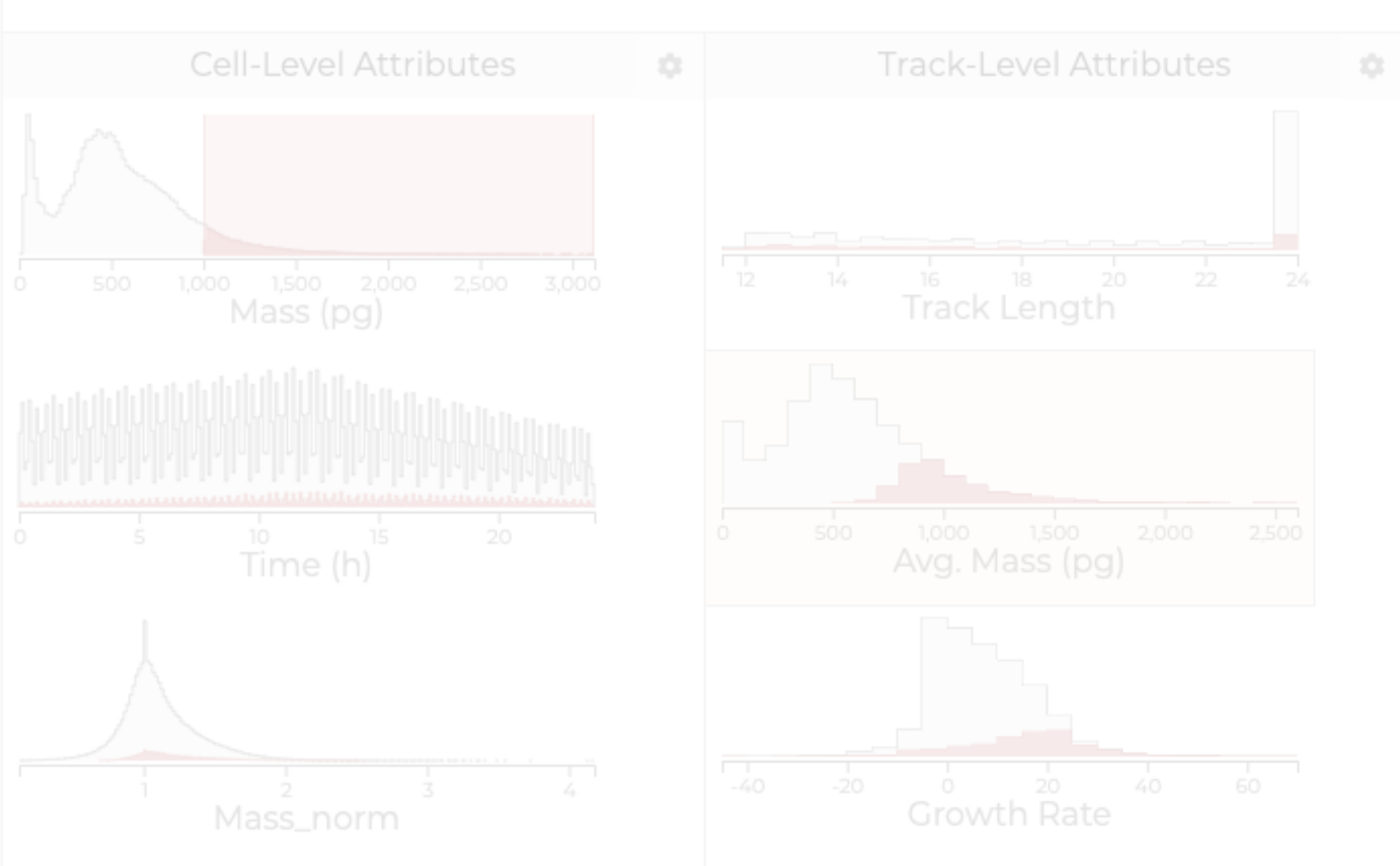
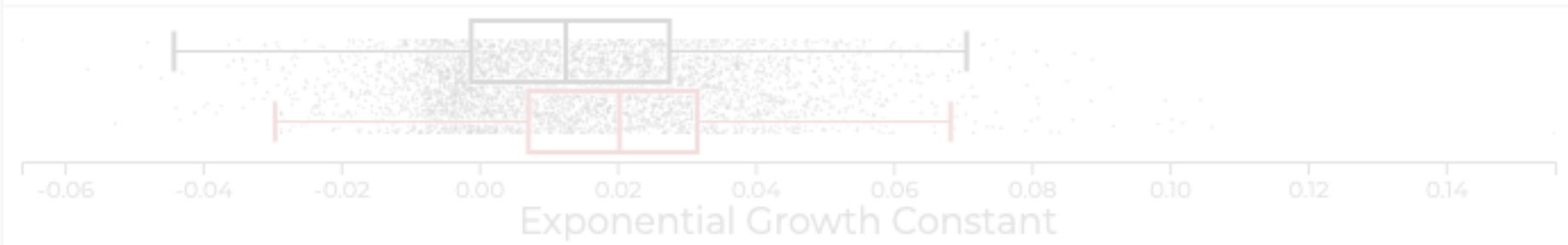
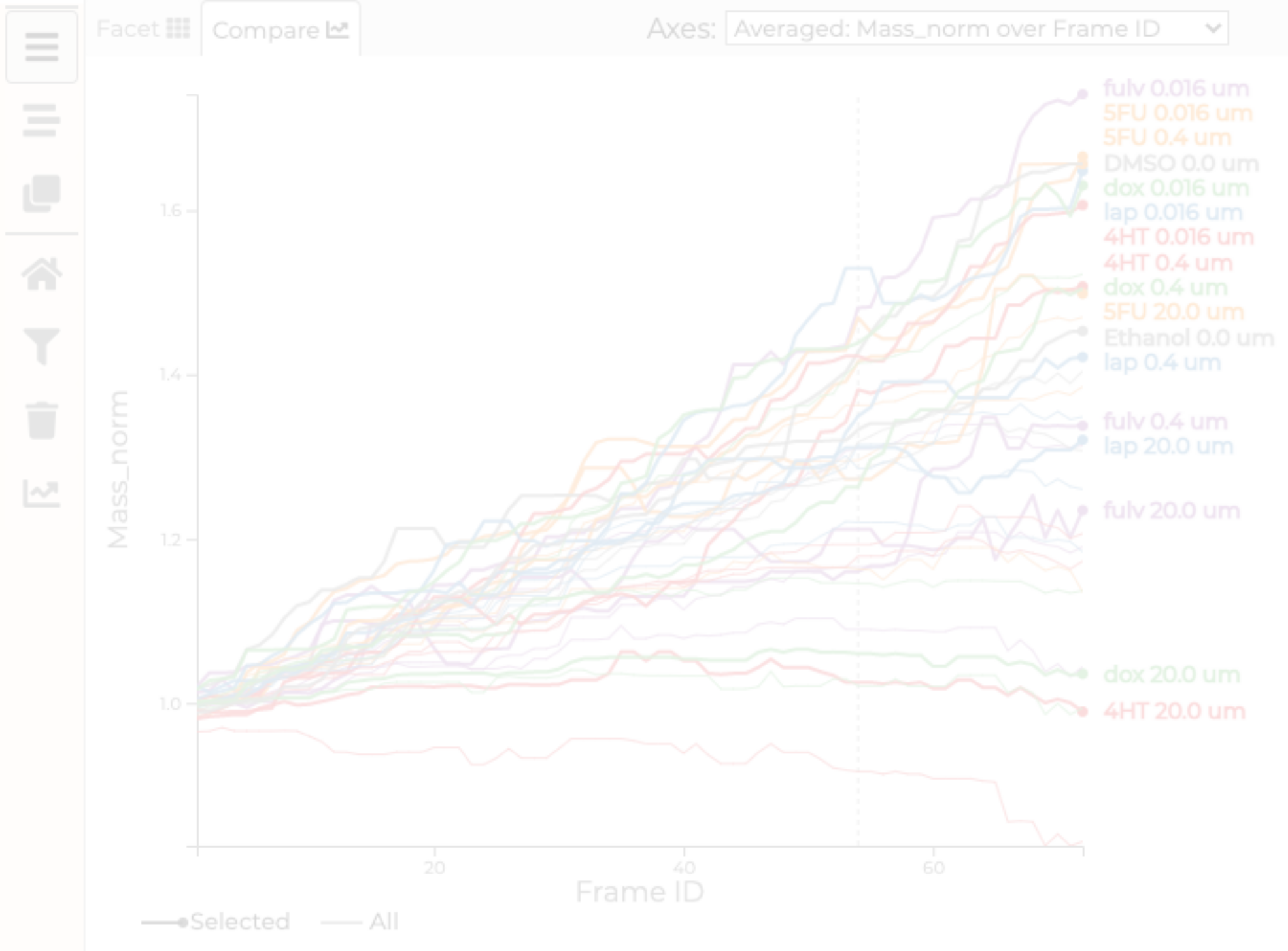
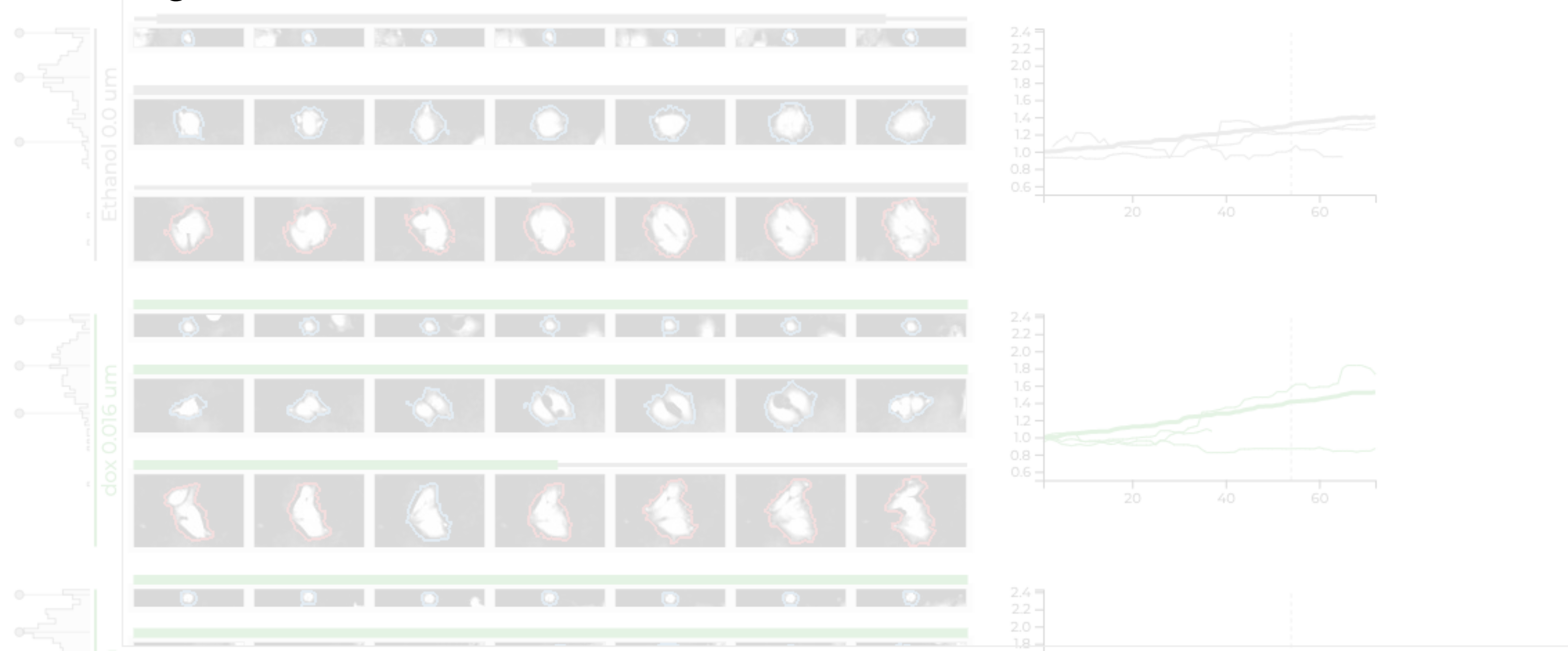


Image Selection View



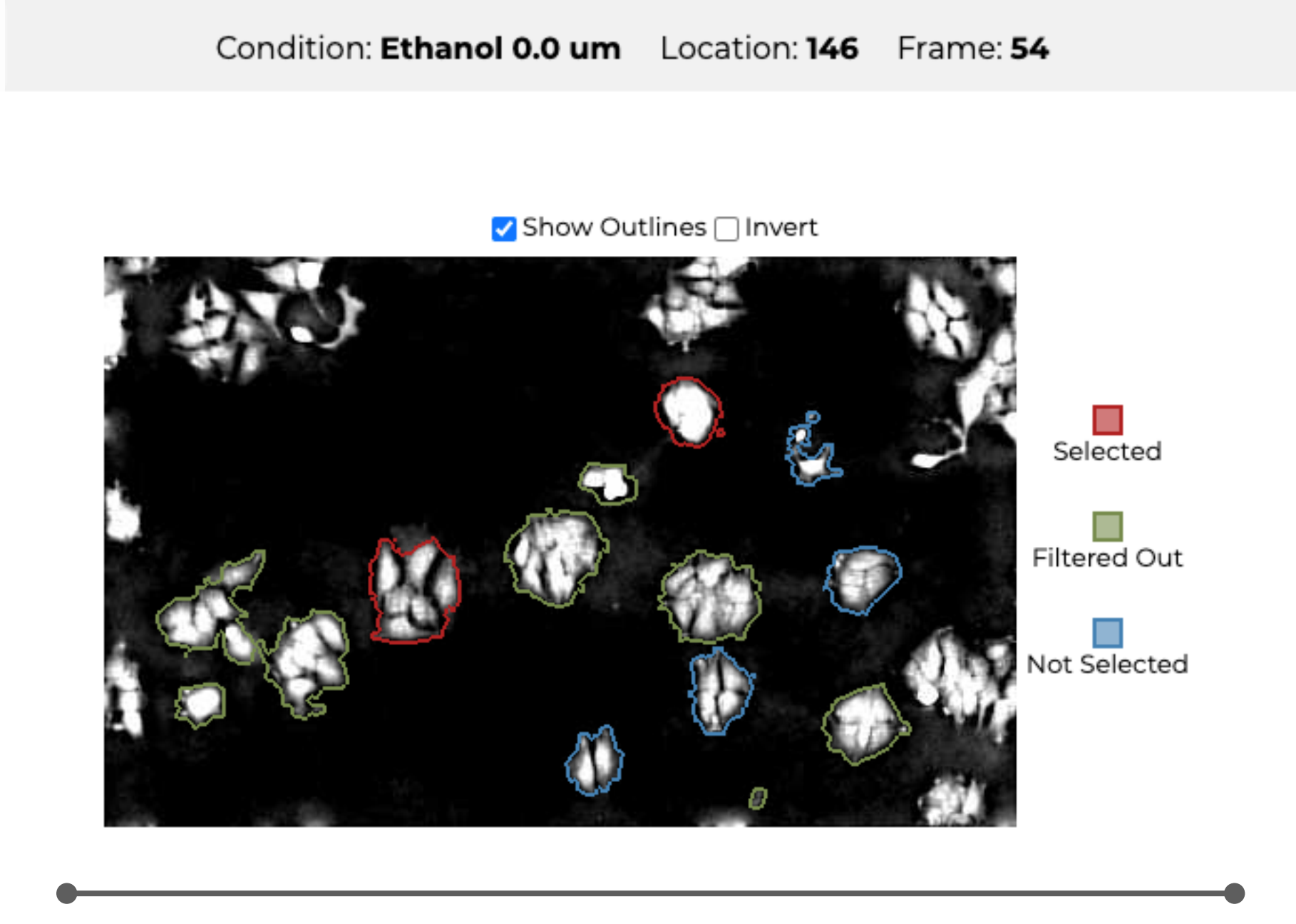
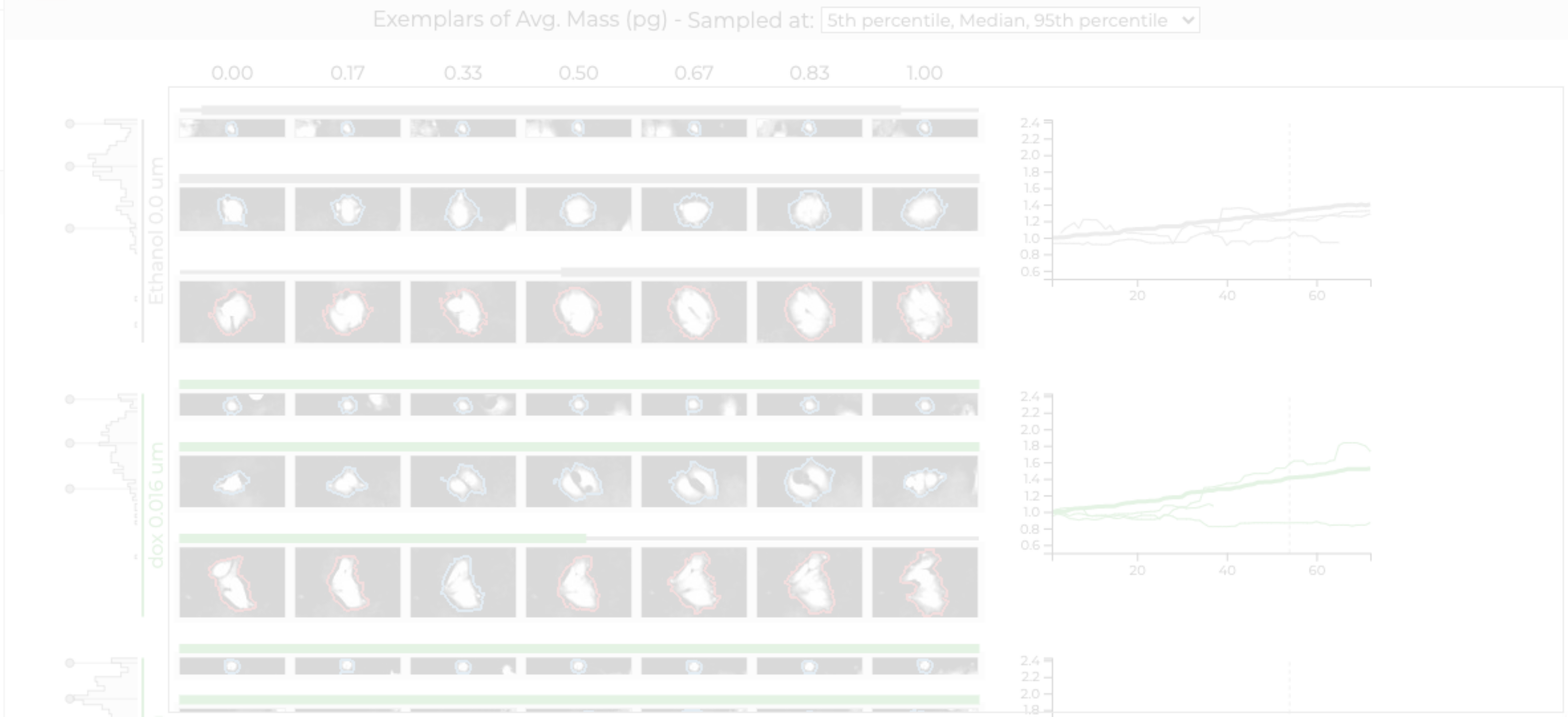
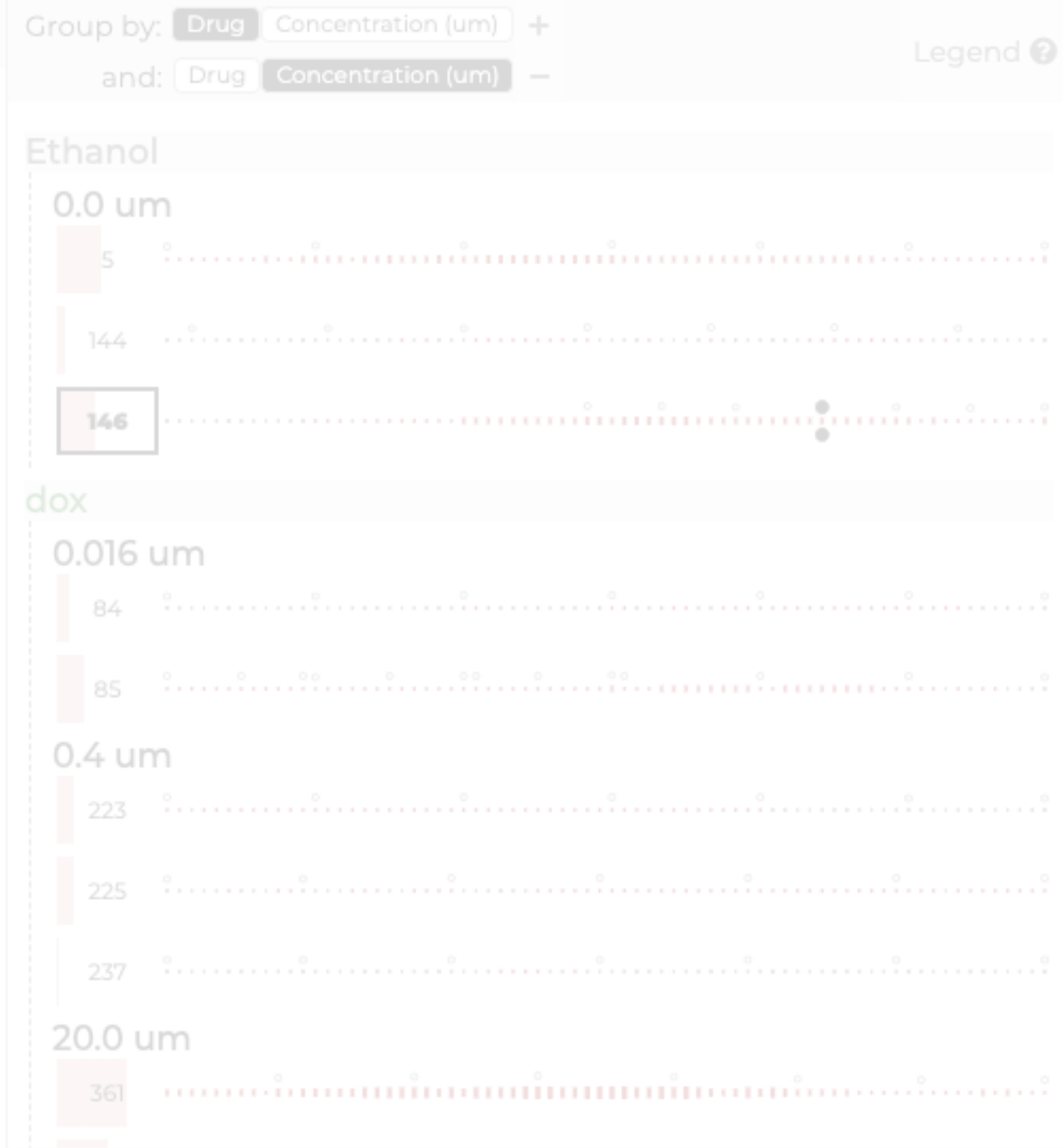
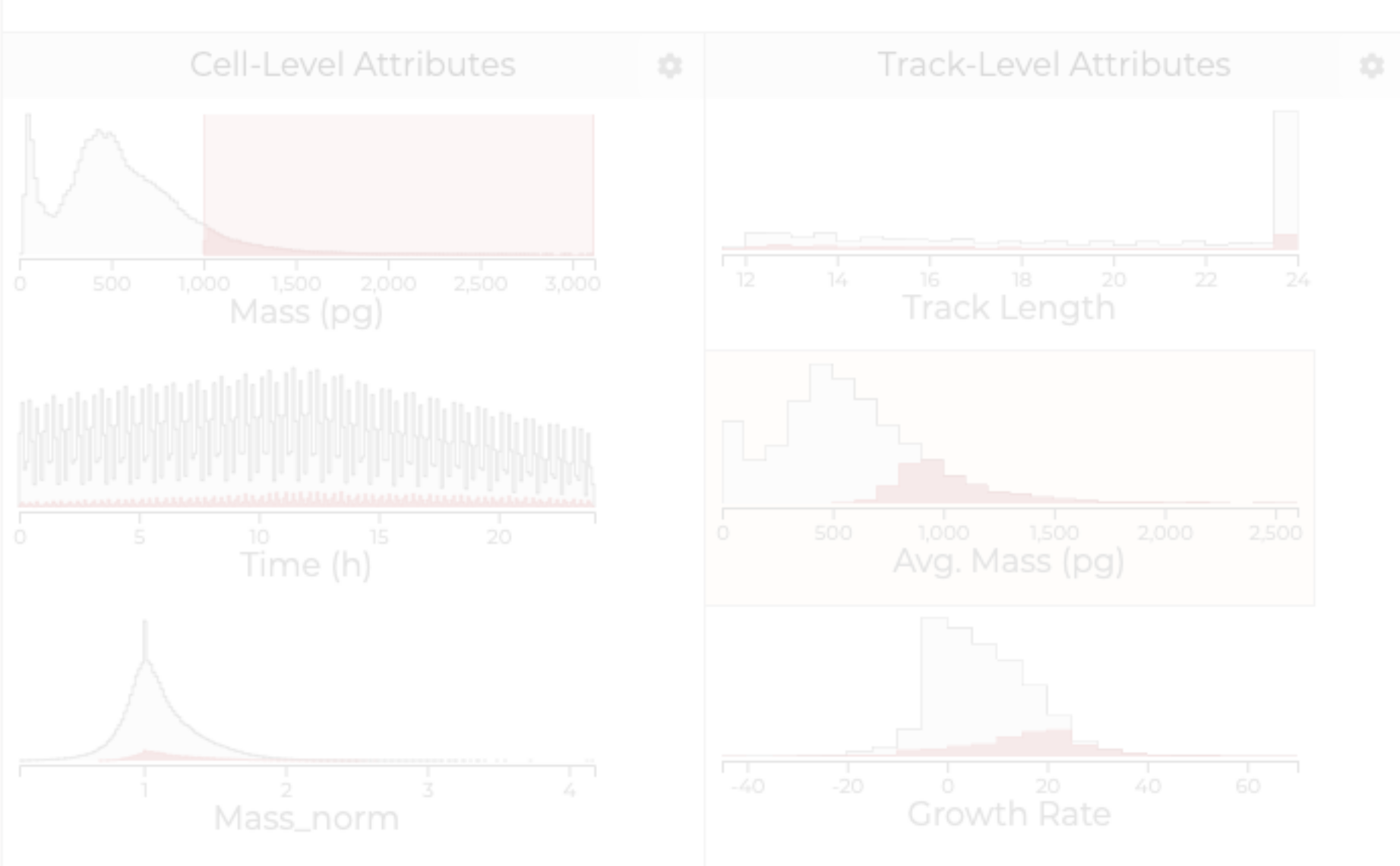
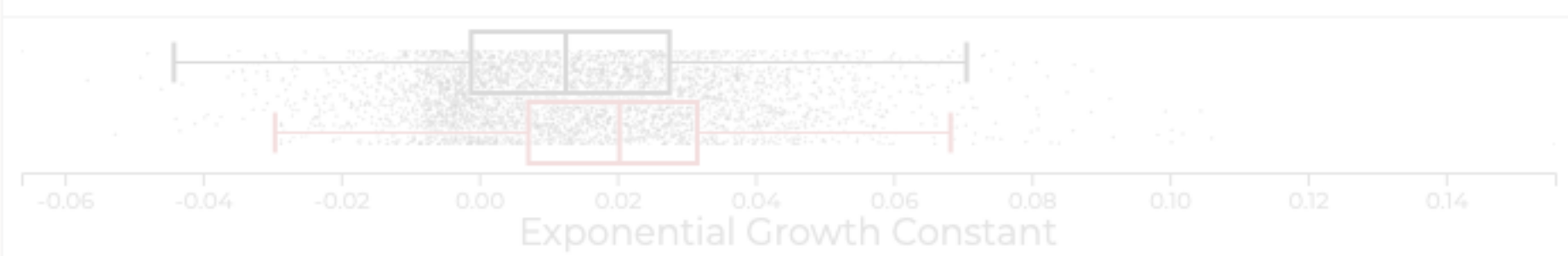
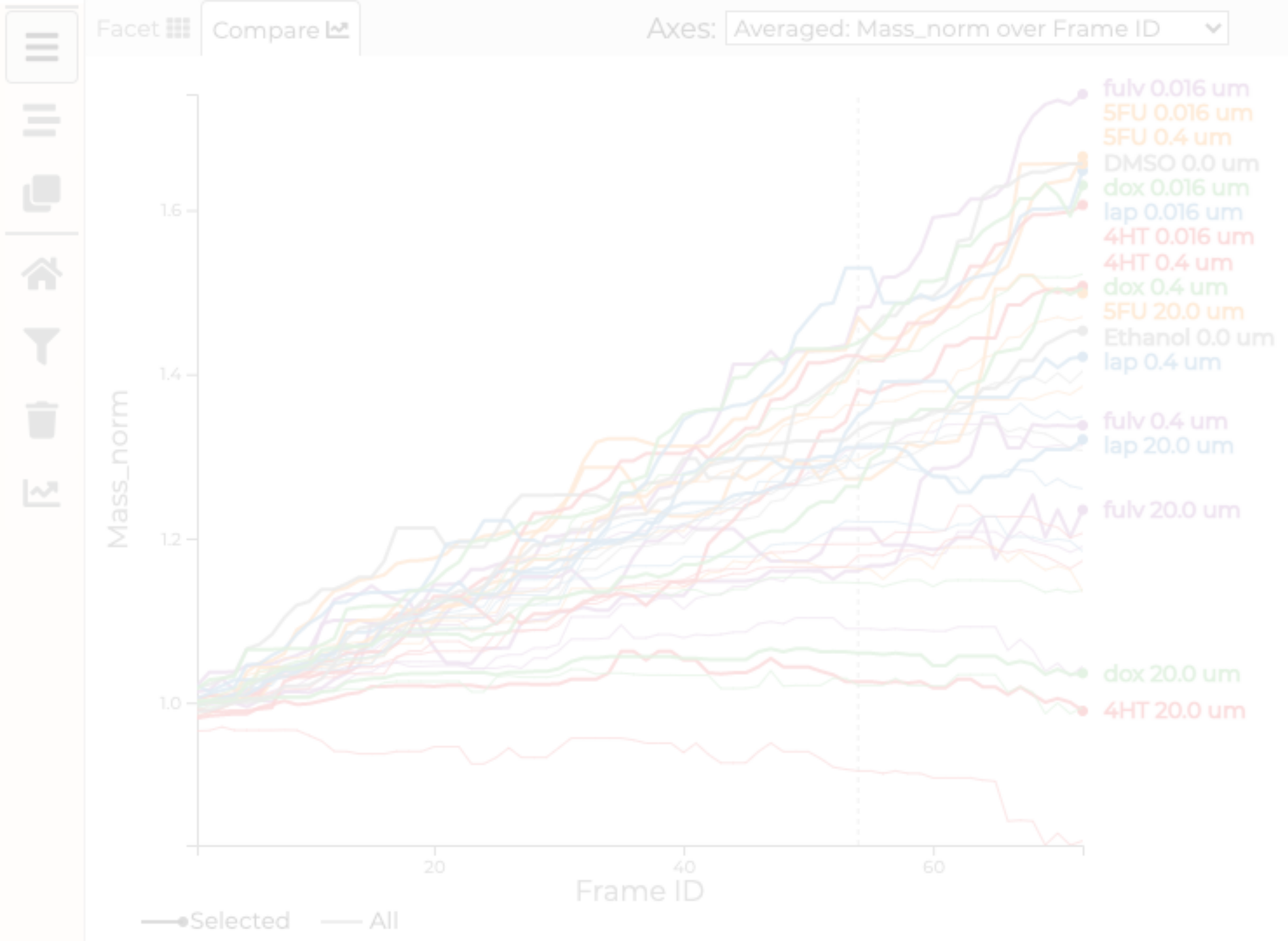
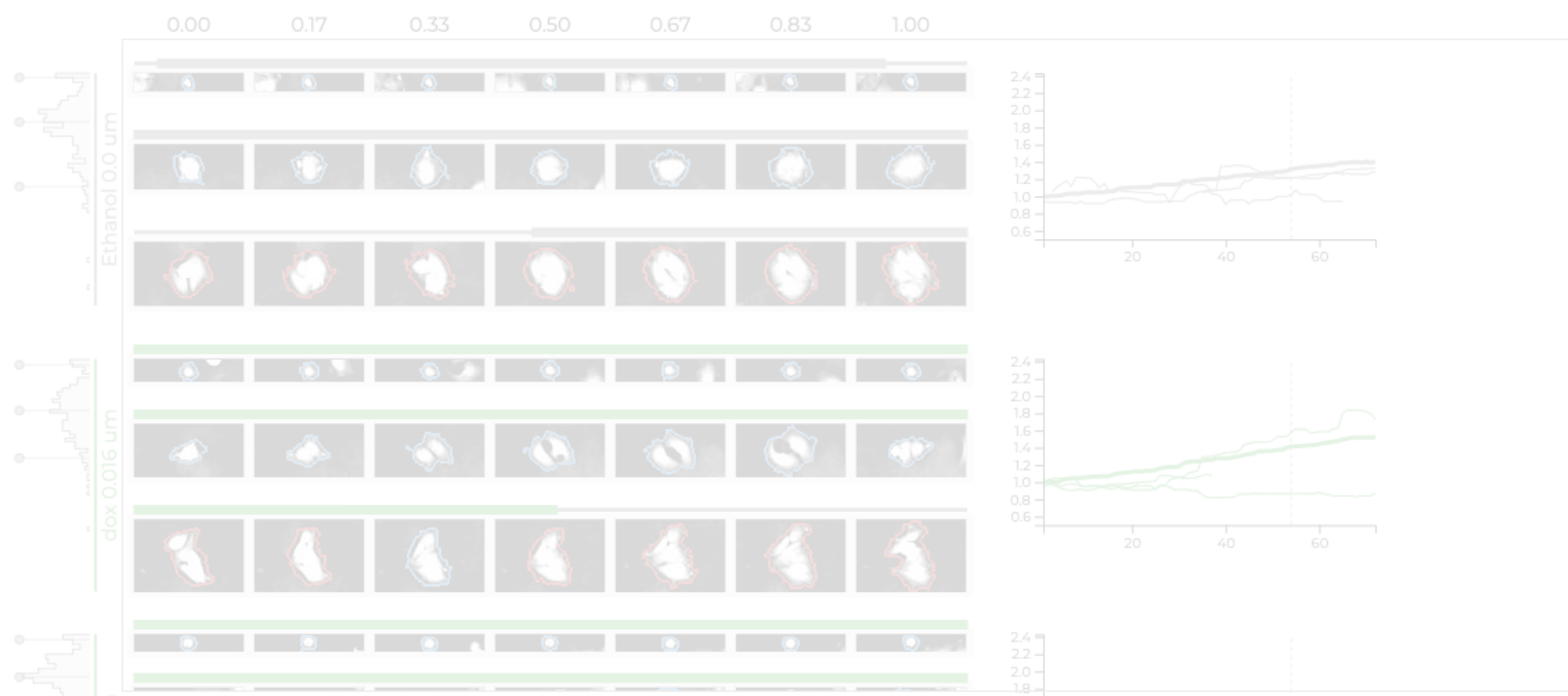
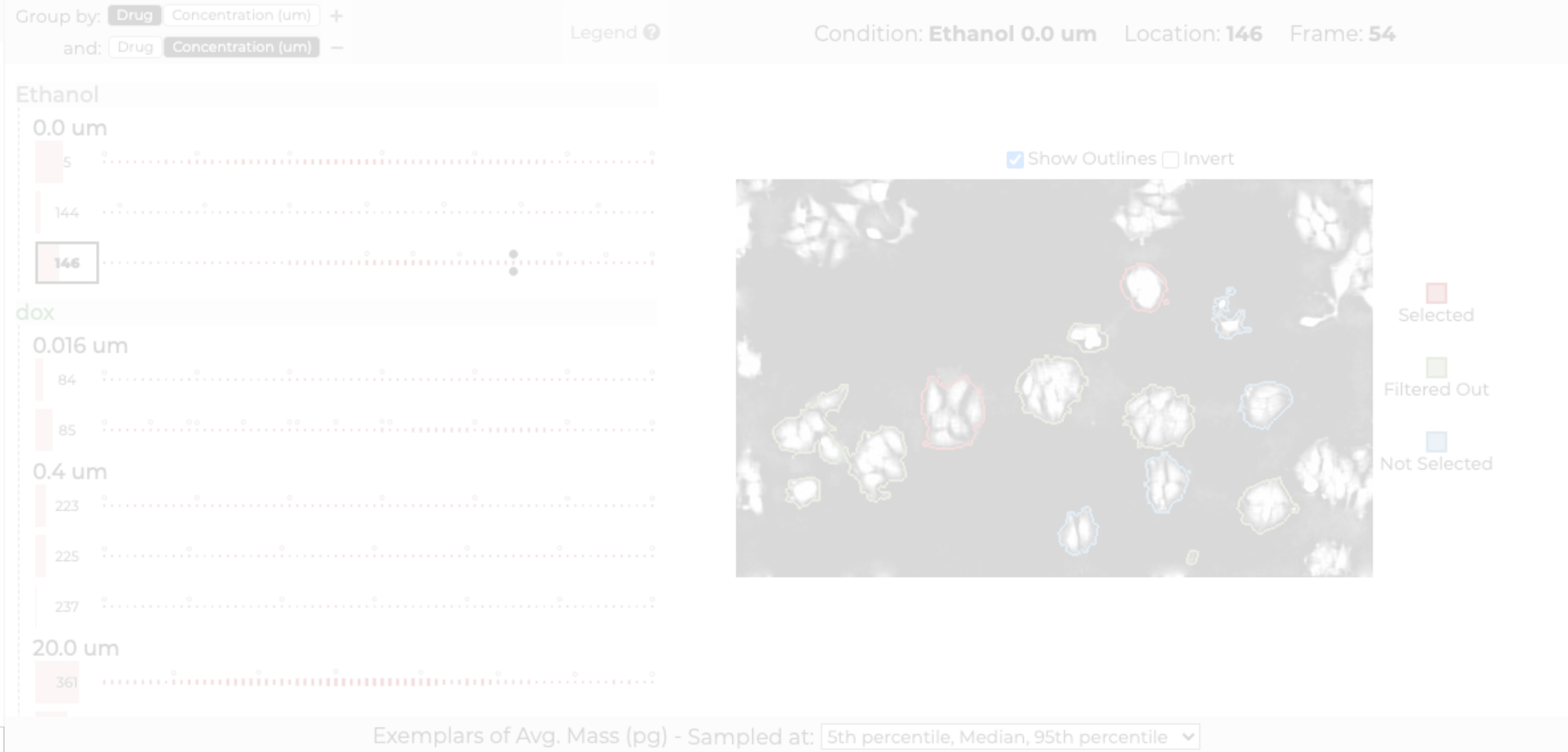
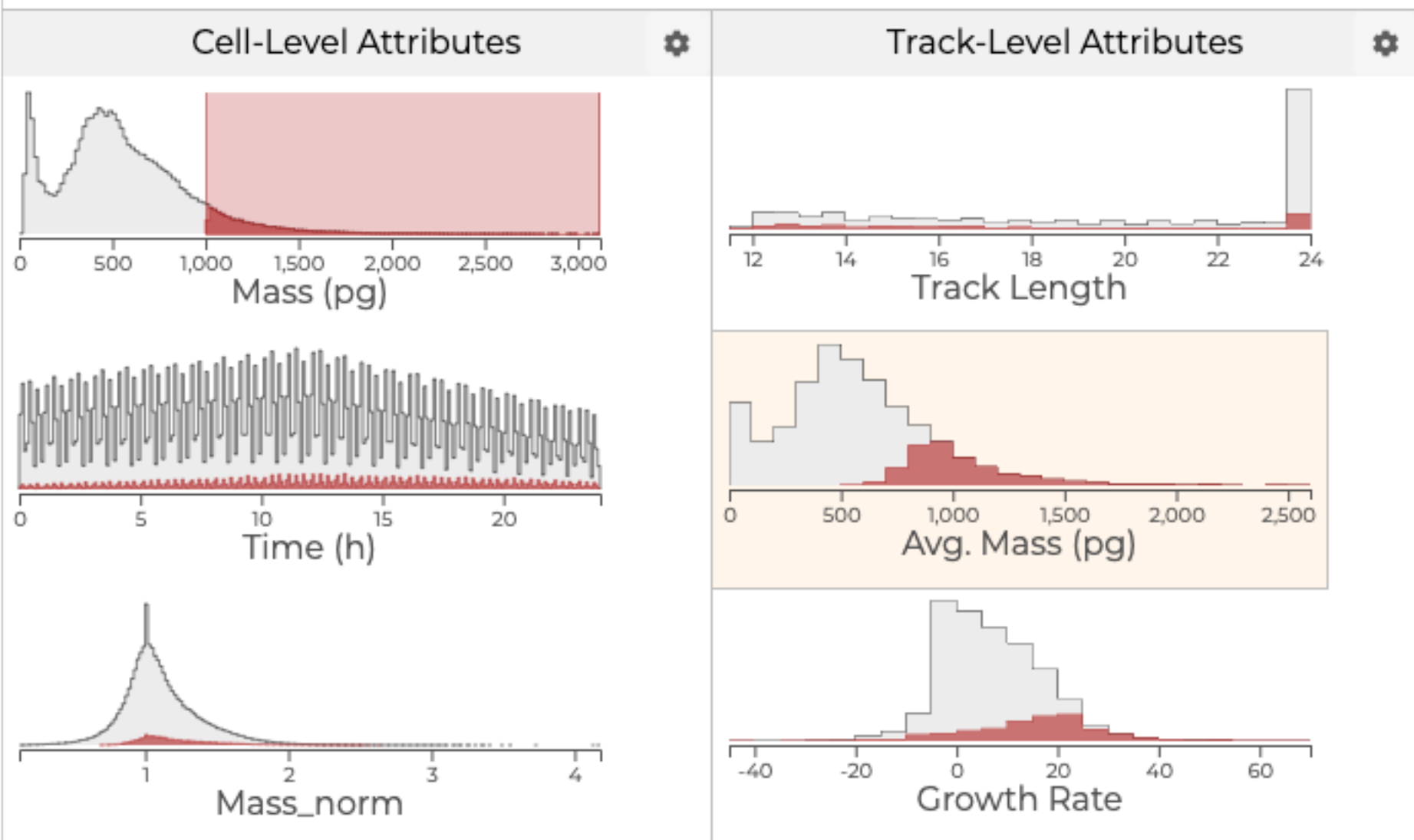
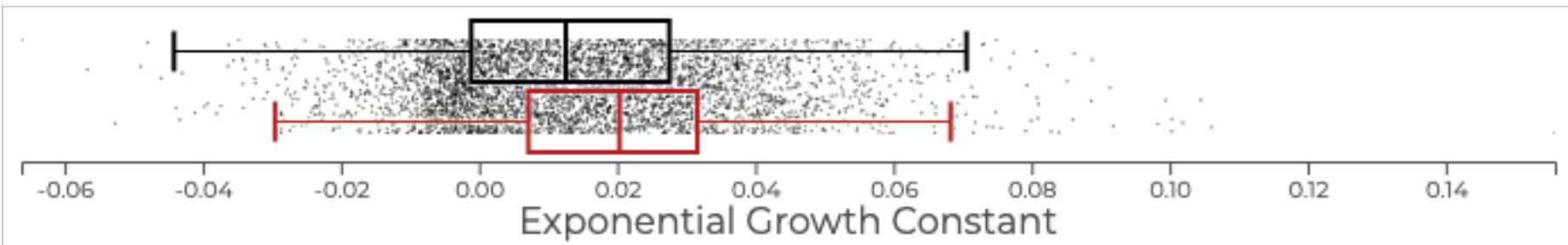
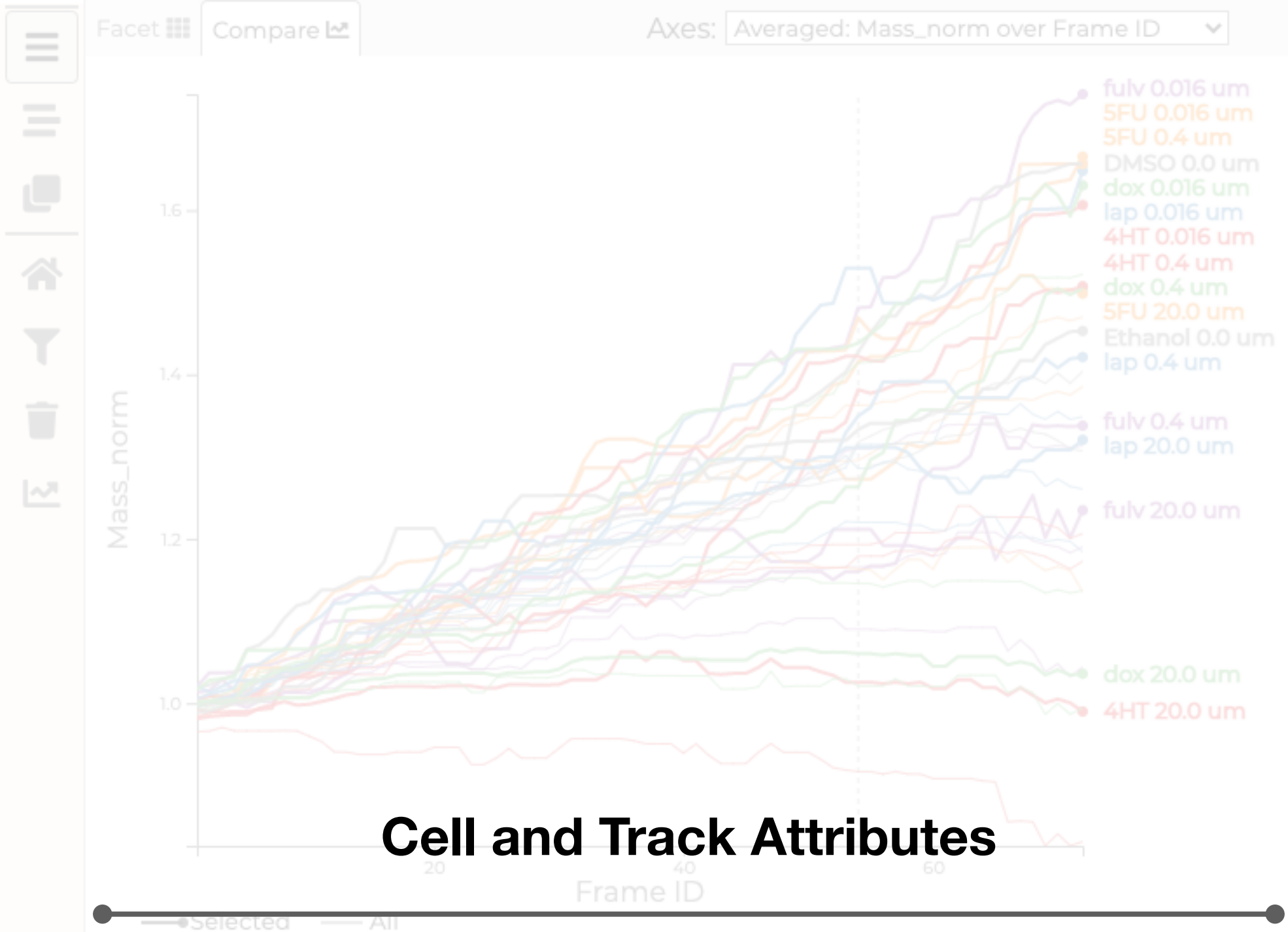
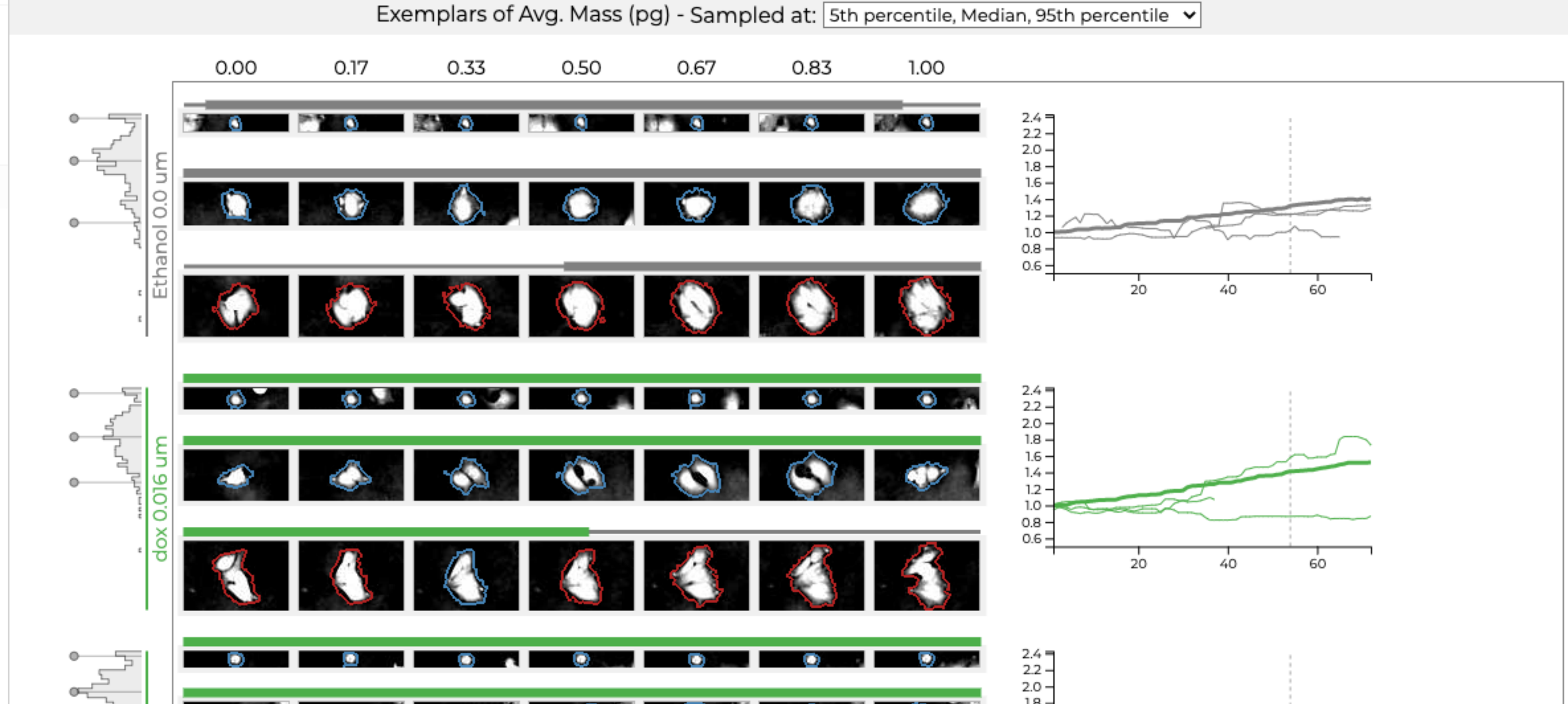
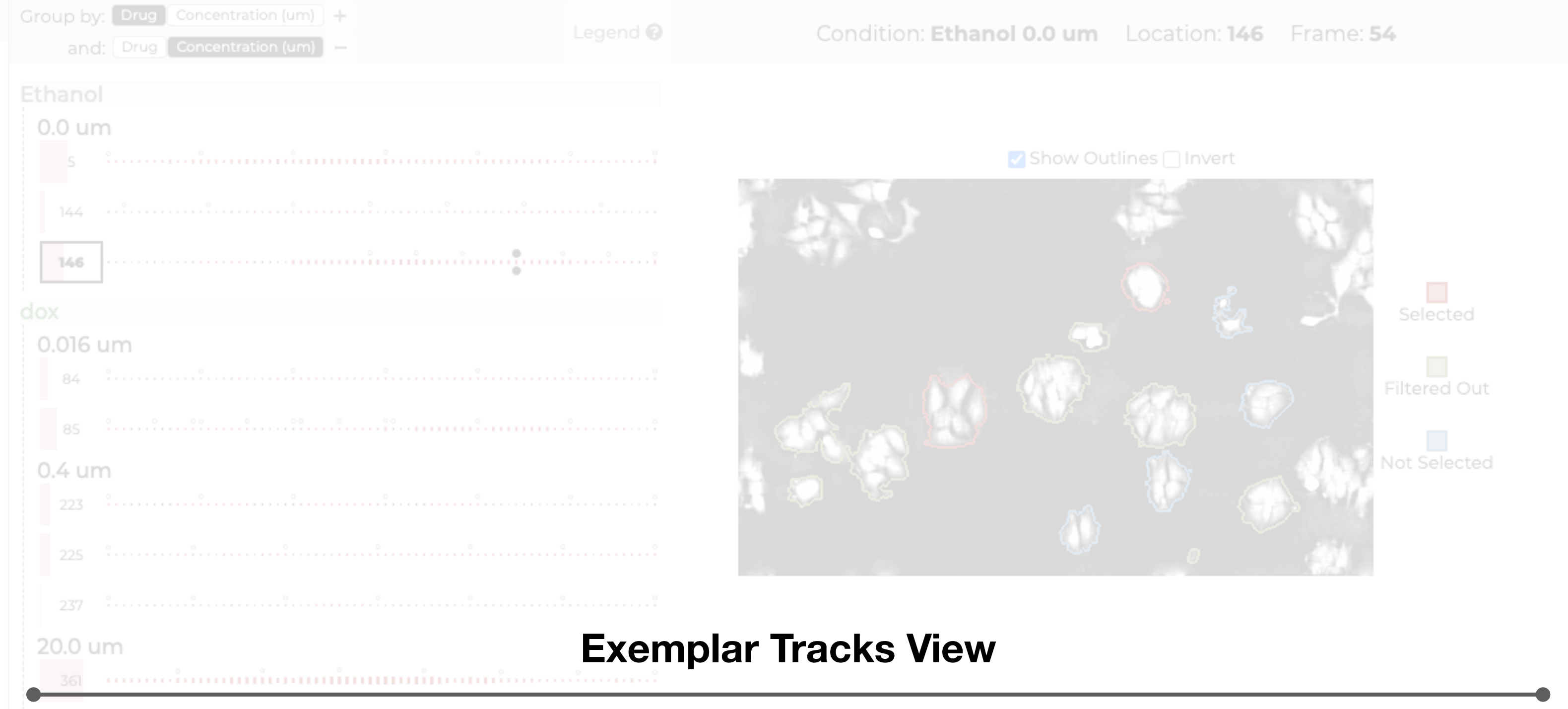
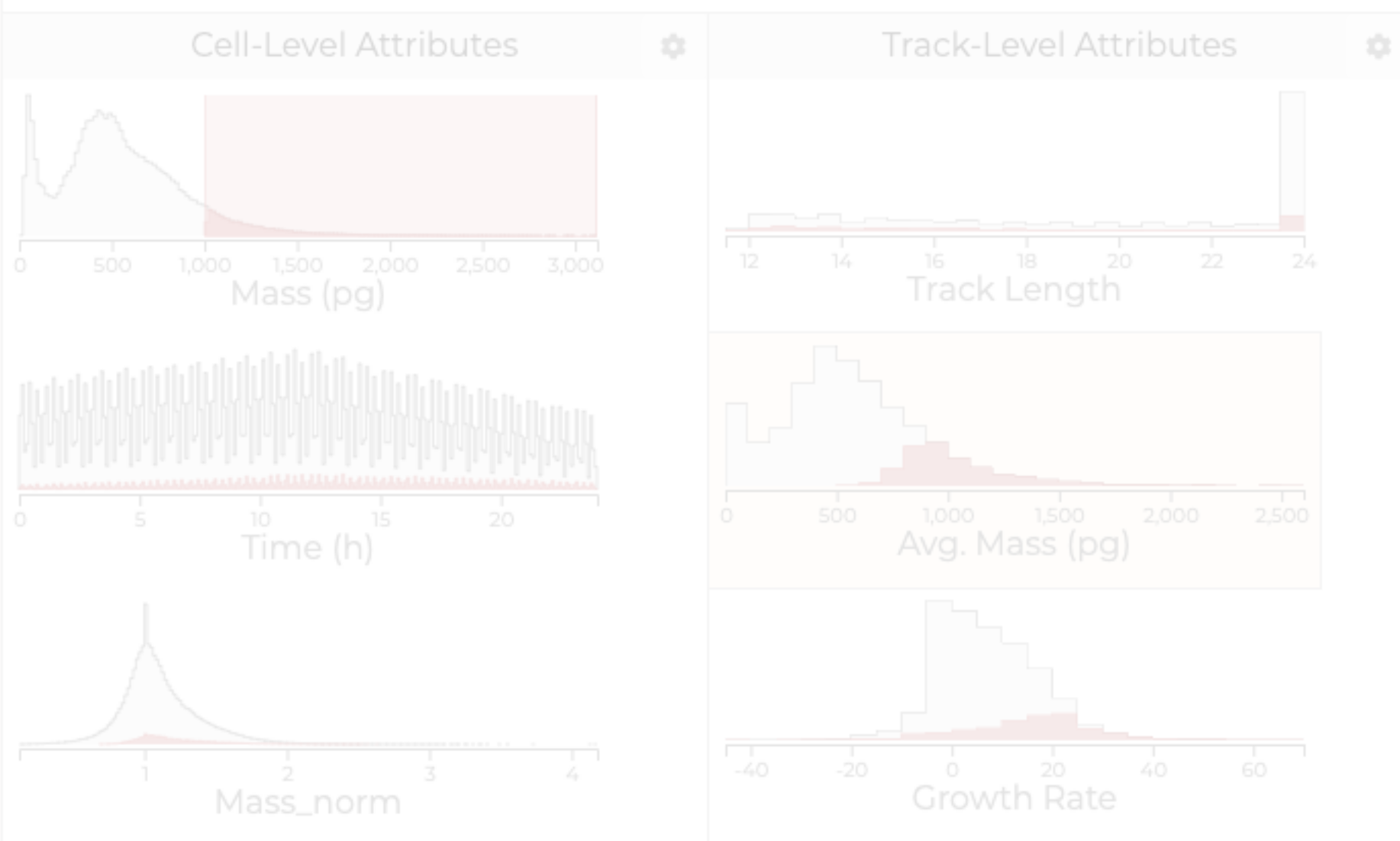
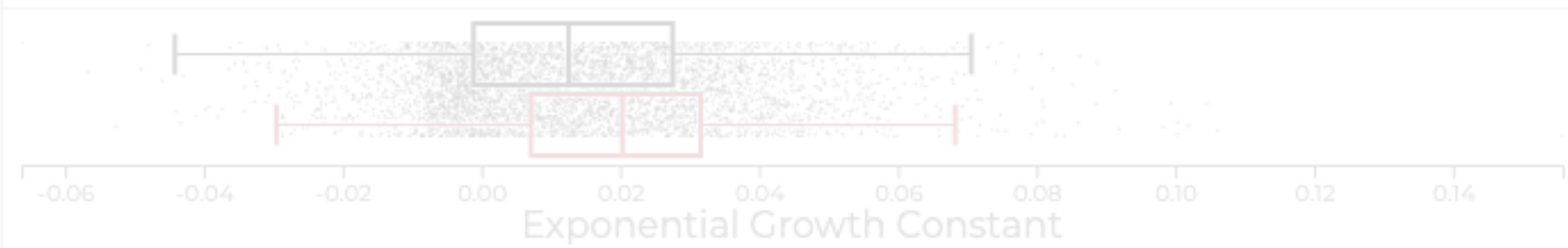
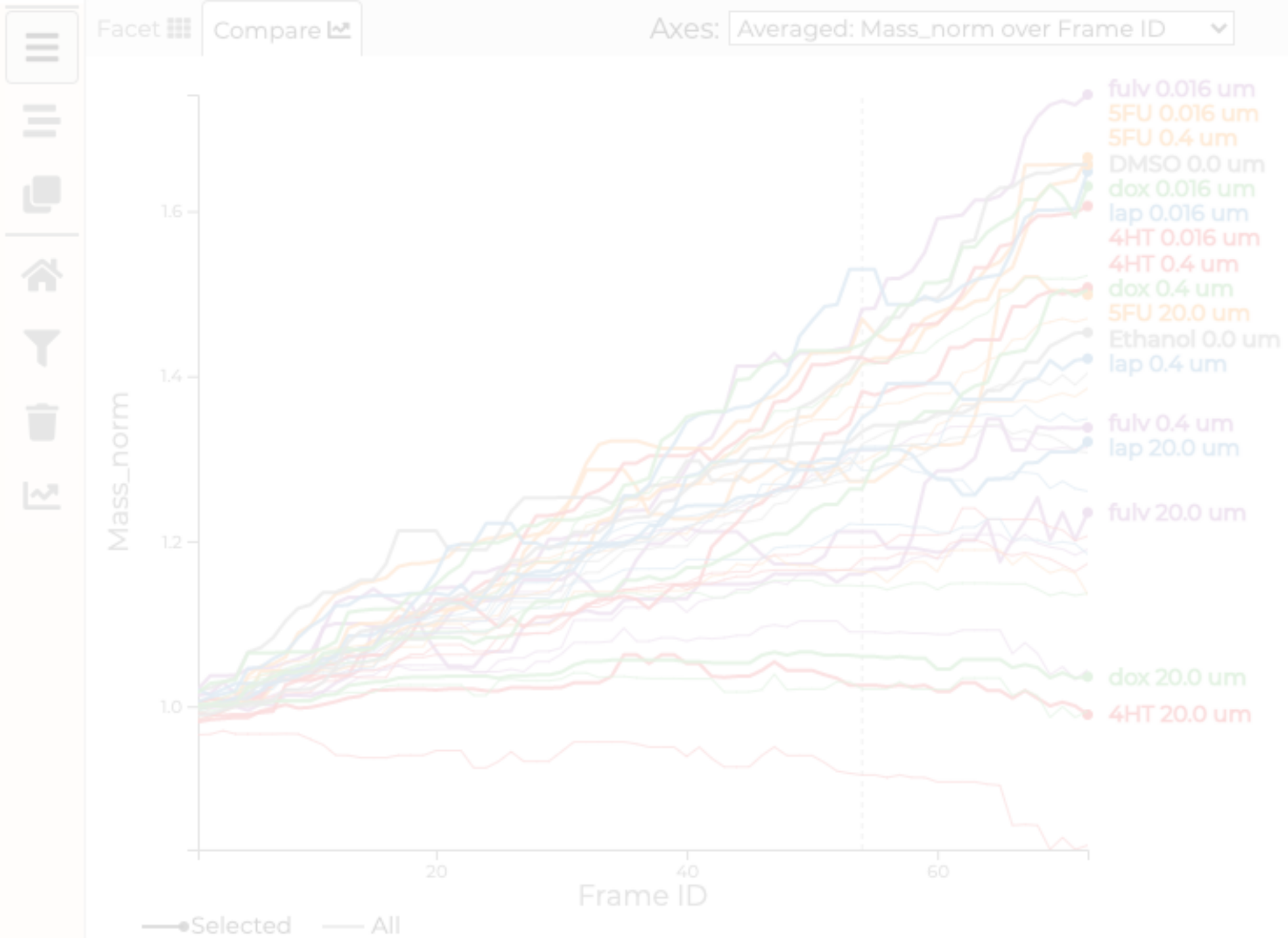
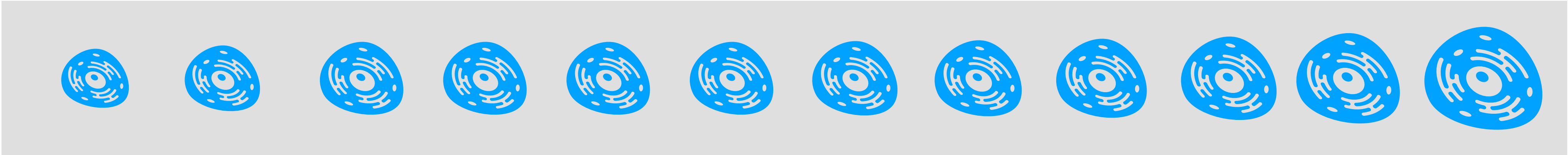
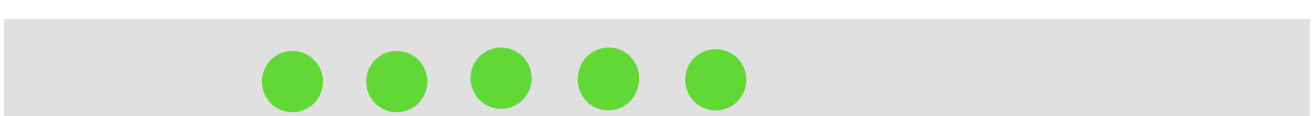
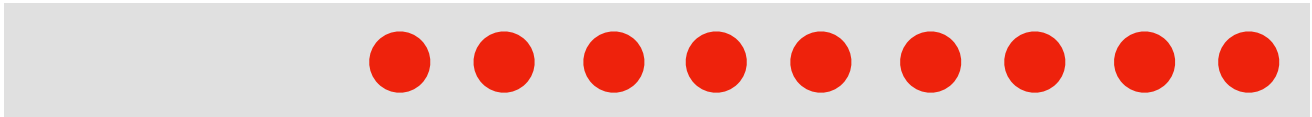
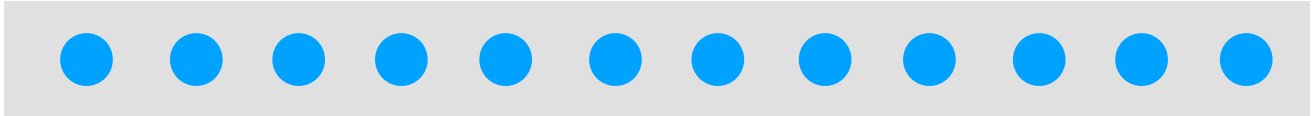


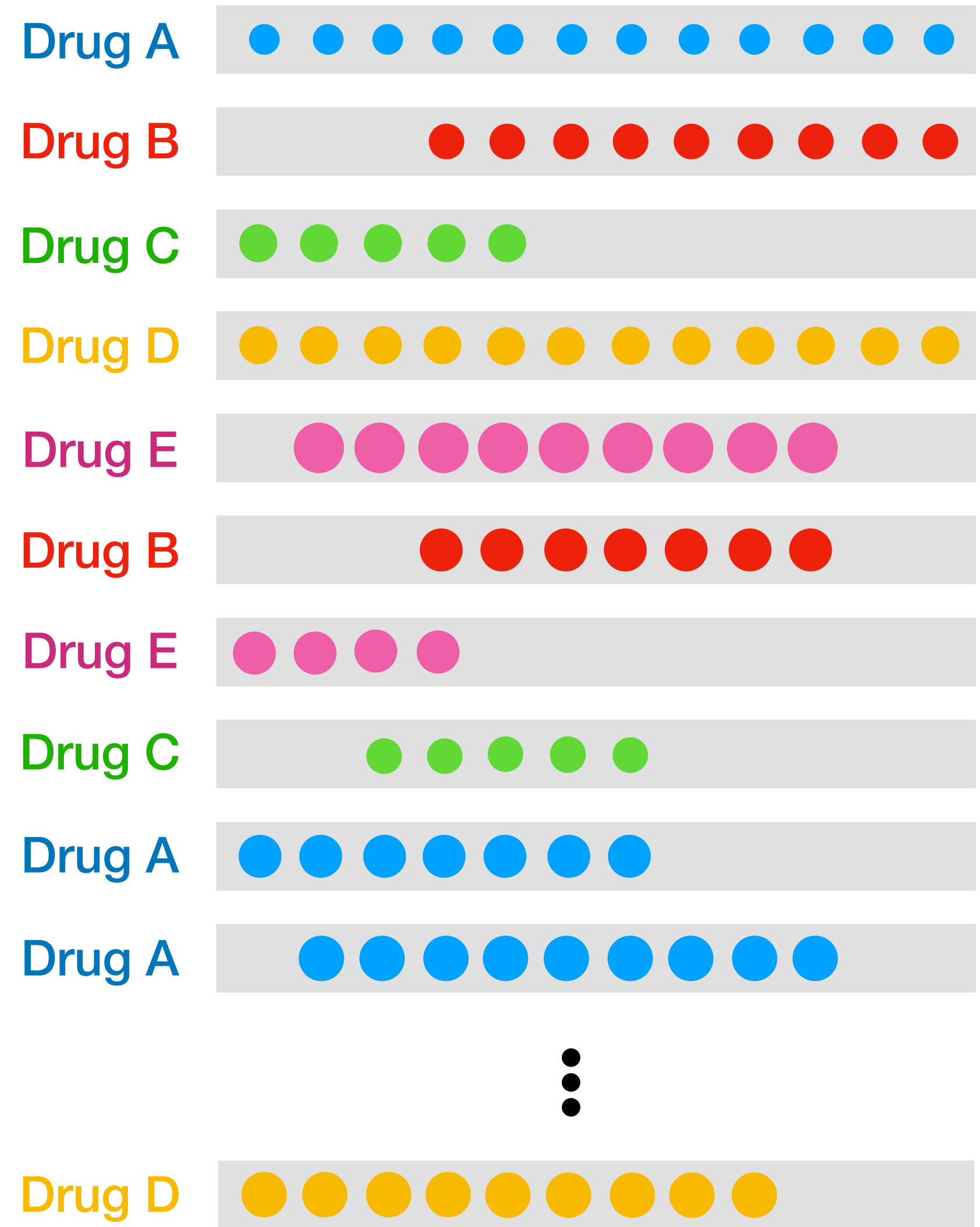
Image View



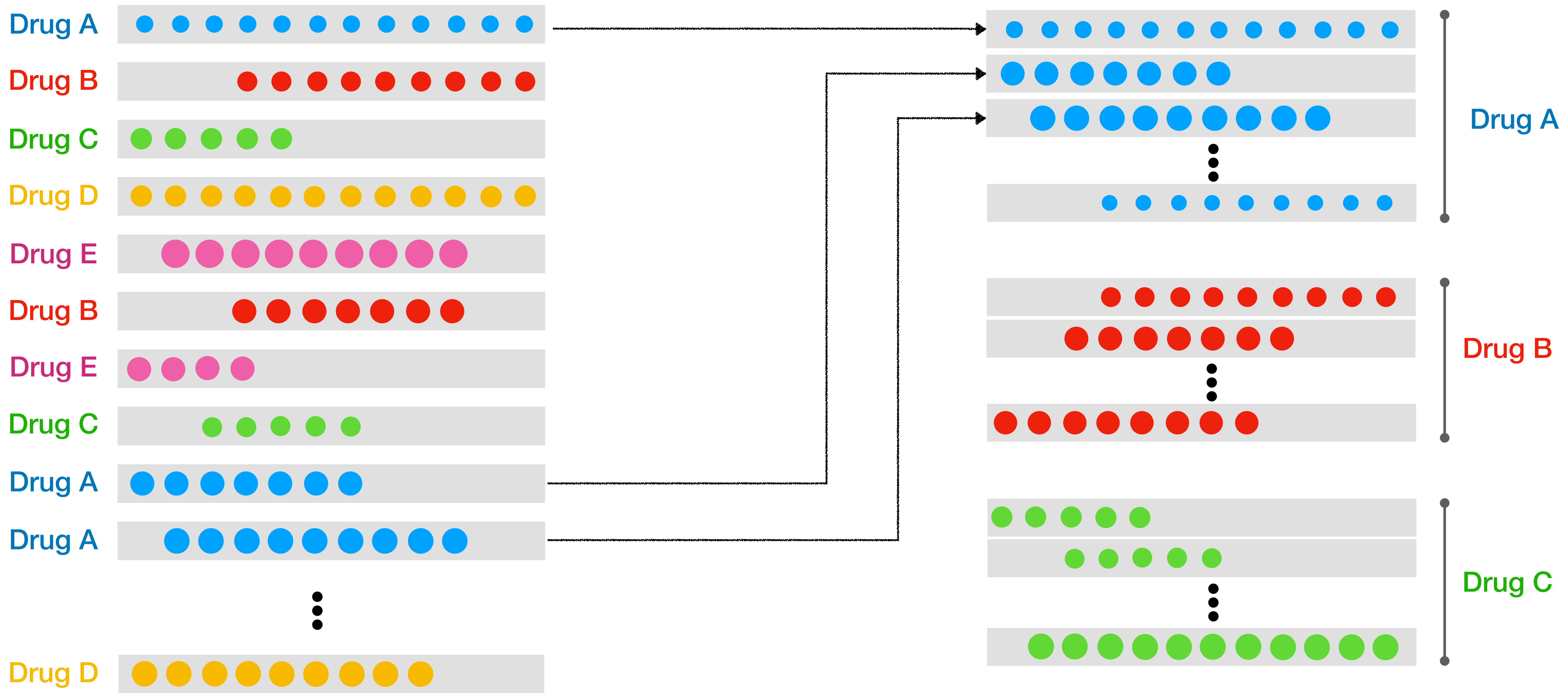






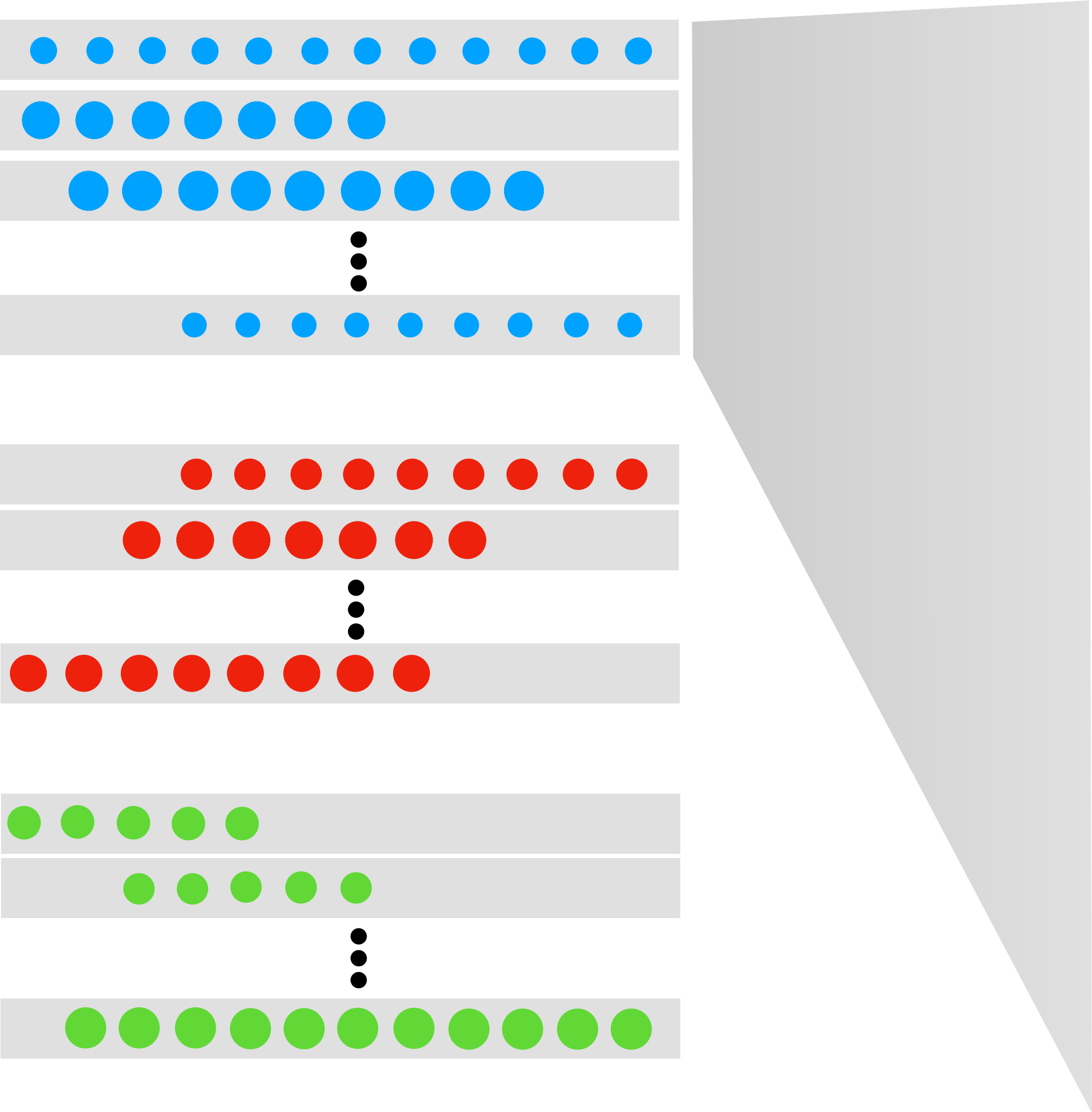


All Tracks

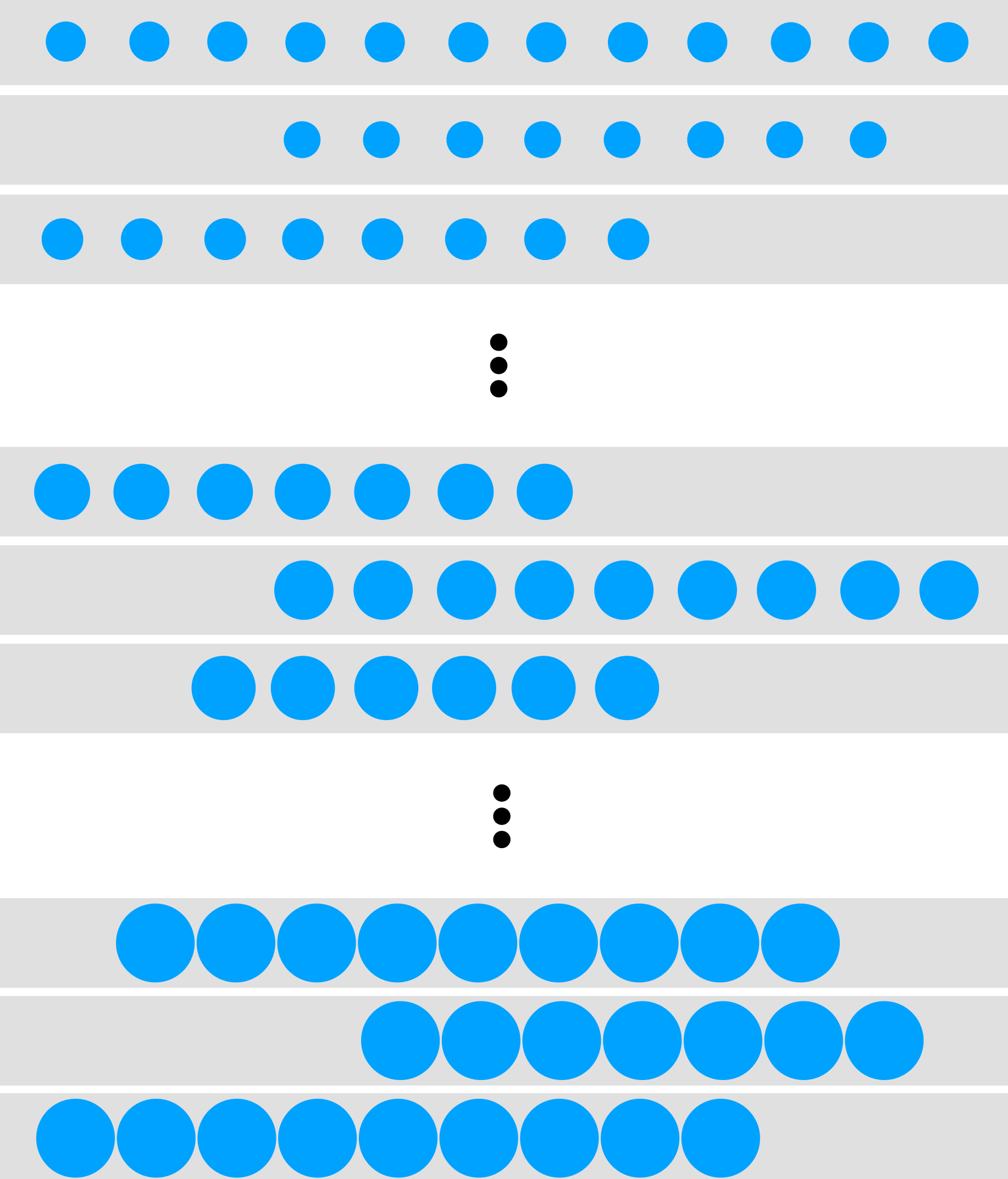


All Tracks

Group

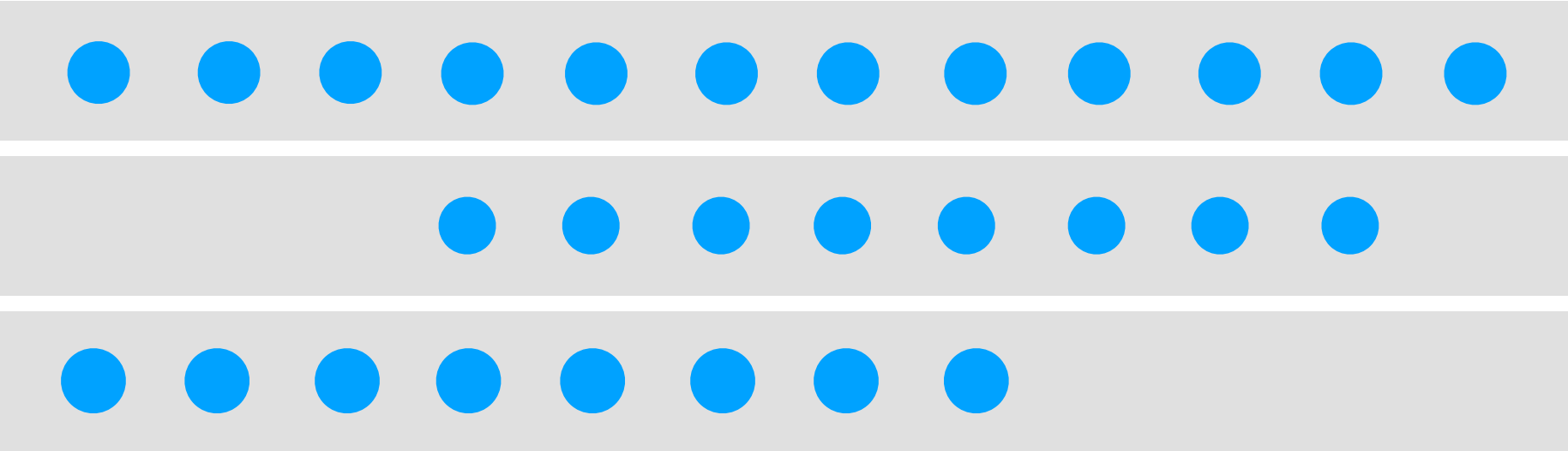


Group

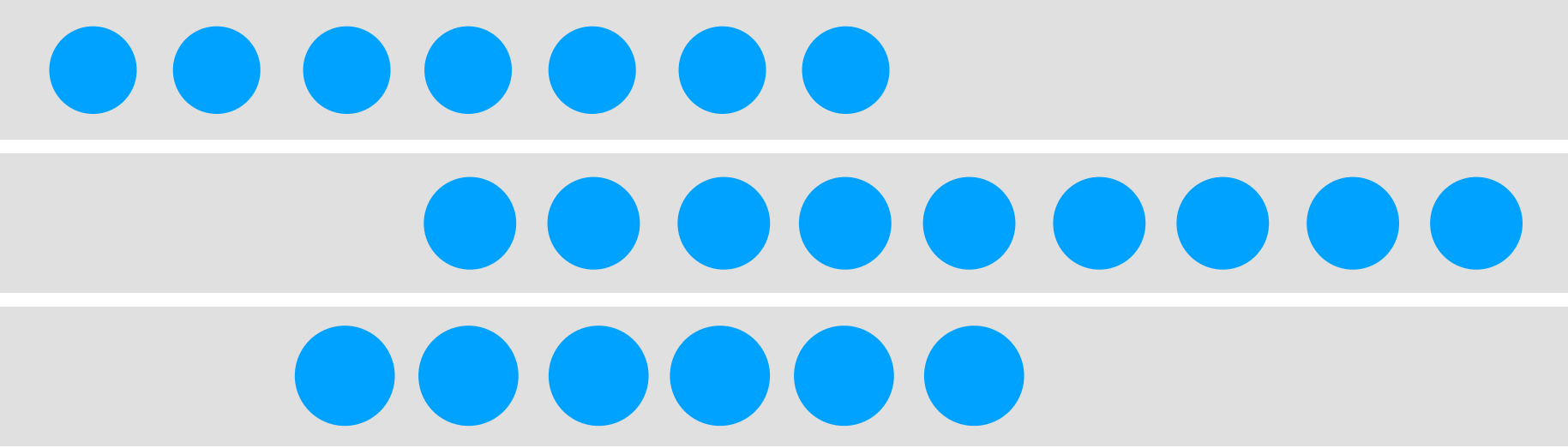


Sort by

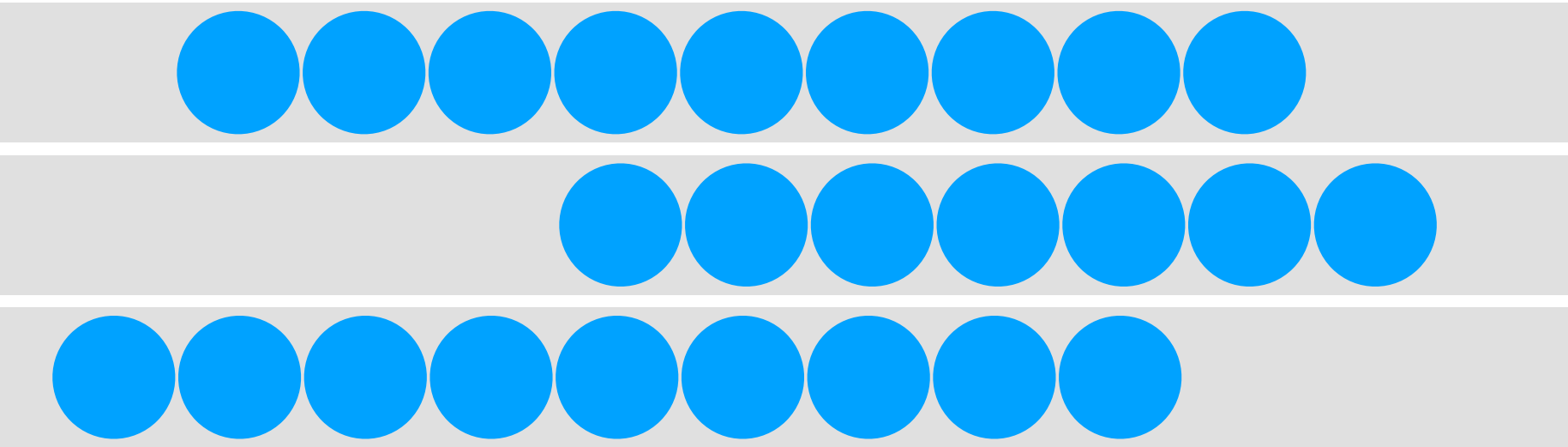
Mass
Shape Factor
Growth Rate



⋮

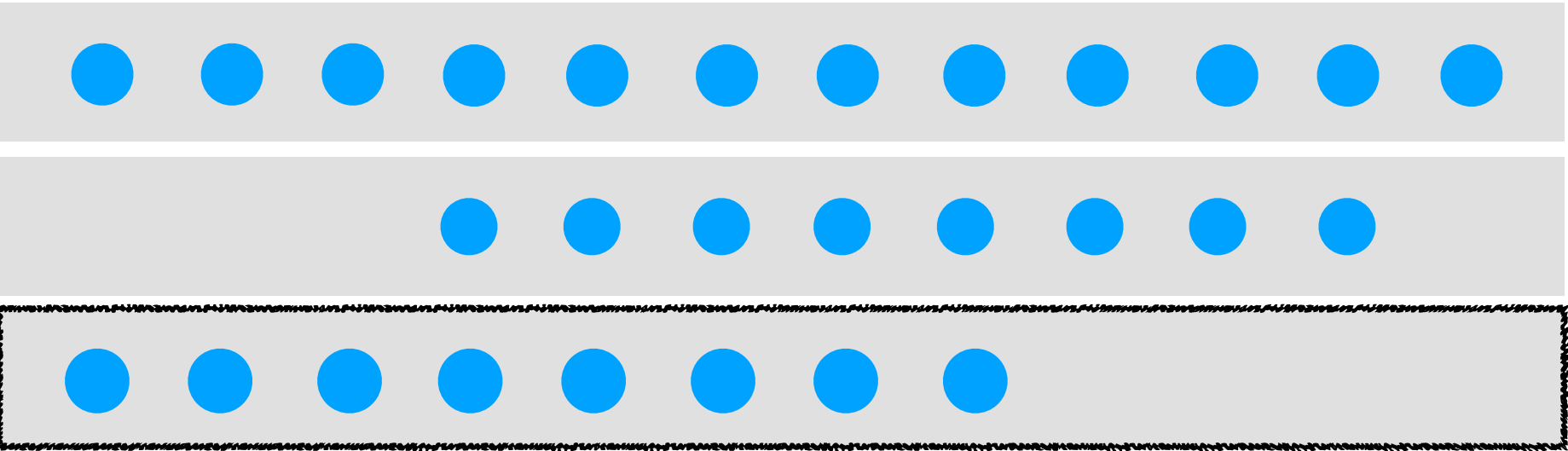


⋮

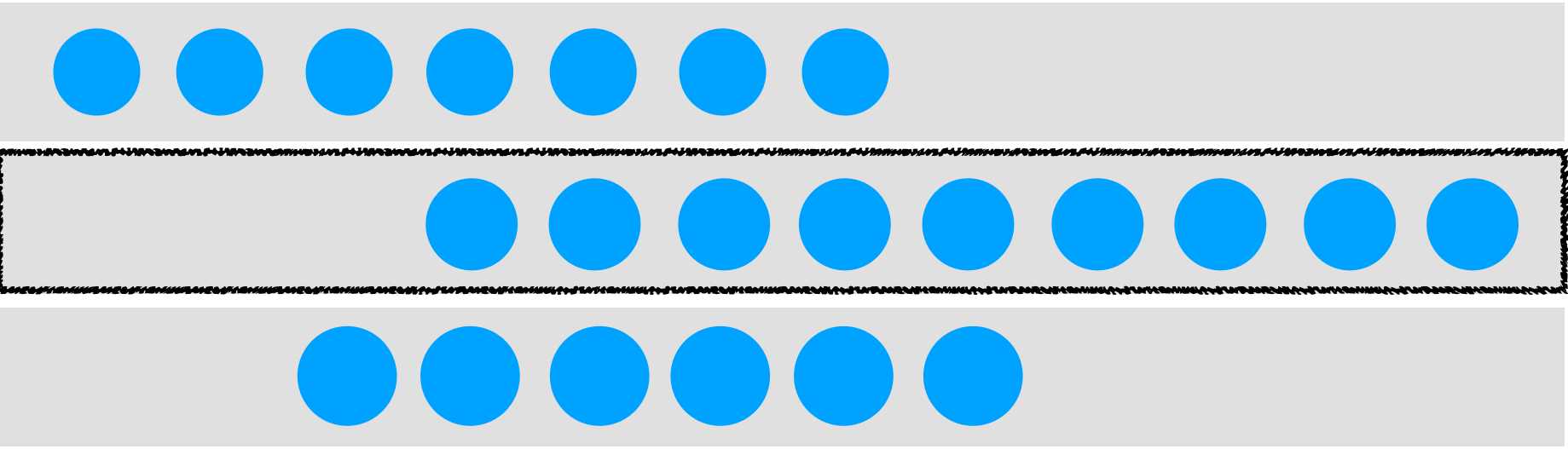


Sort by

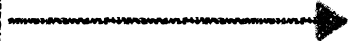
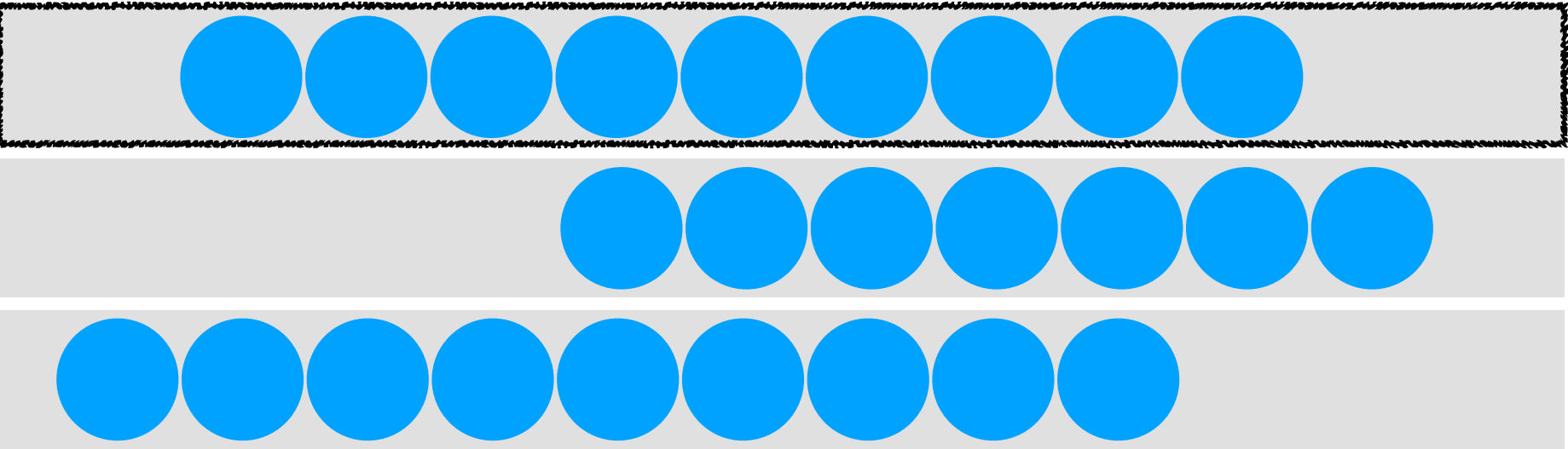
- Mass
- Shape Factor
- Growth Rate



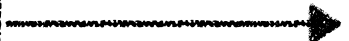
⋮



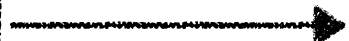
⋮



5th Percentile



Median



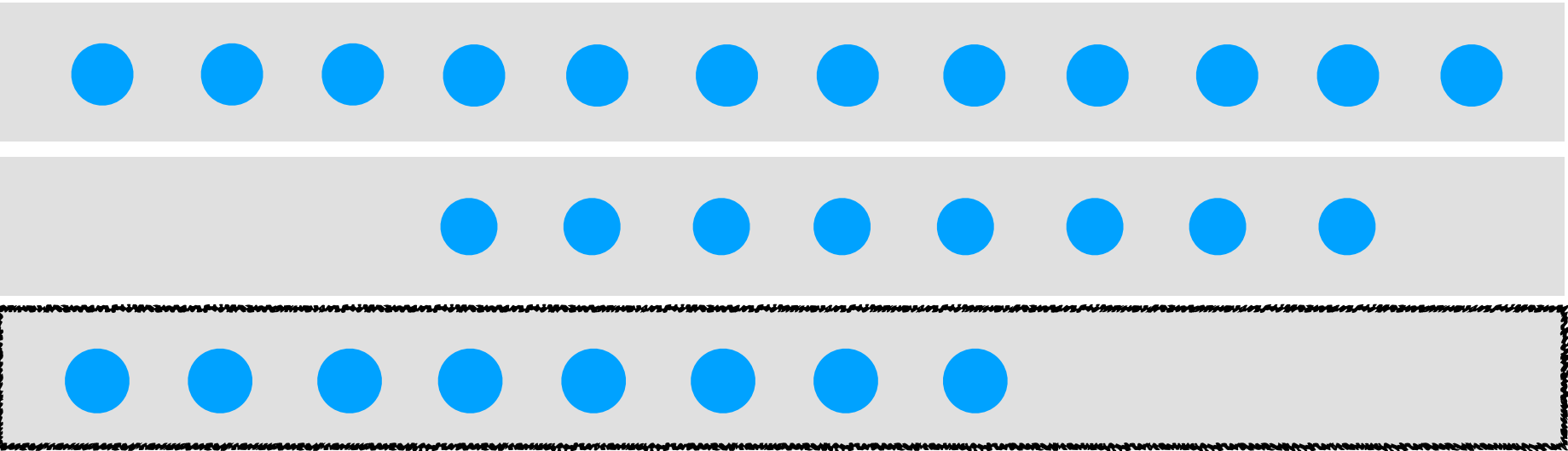
95th Percentile

Sort by

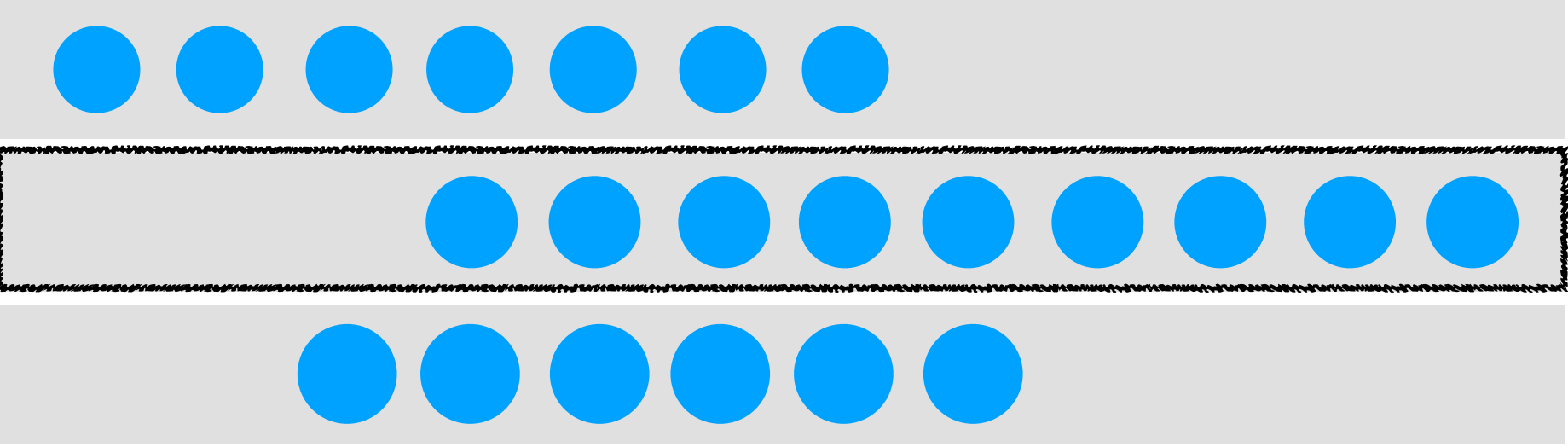
Mass
Shape Factor
Growth Rate

Sample Tracks

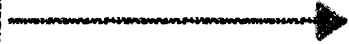
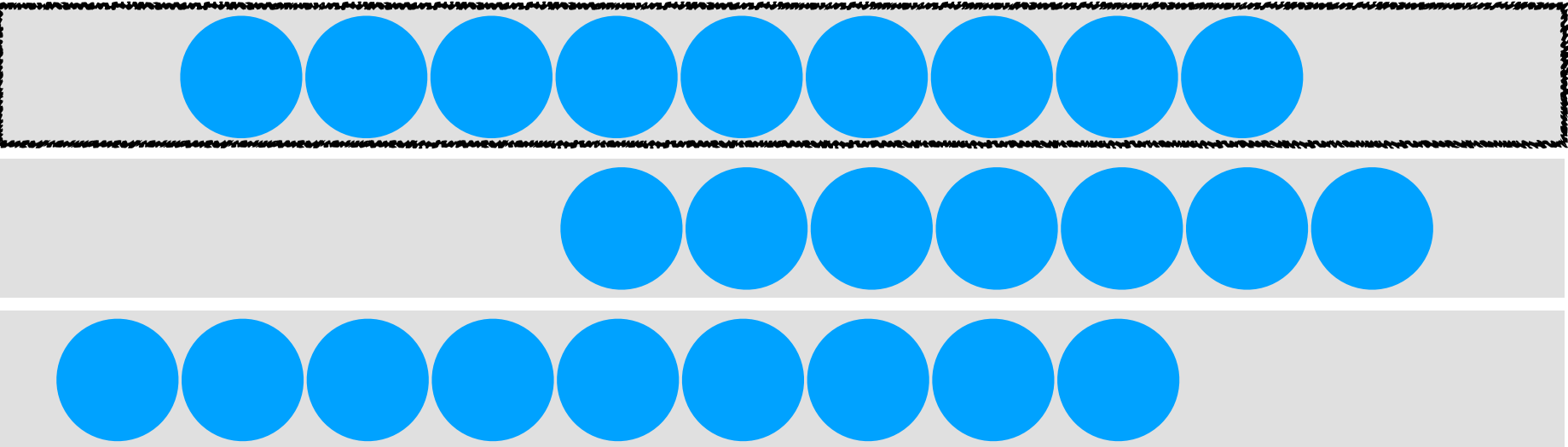
5th, Median, 95th
Min, Median, Max
25th, Median, 75th



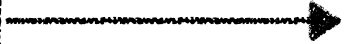
⋮



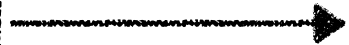
⋮



5th Percentile



Median



95th Percentile

Sort by

Mass
Shape Factor
Growth Rate

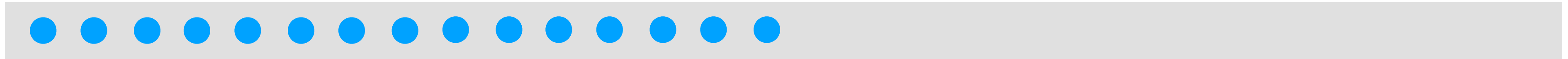
Sample Tracks

5th, Median, 95th
Min, Median, Max
25th, Median, 75th

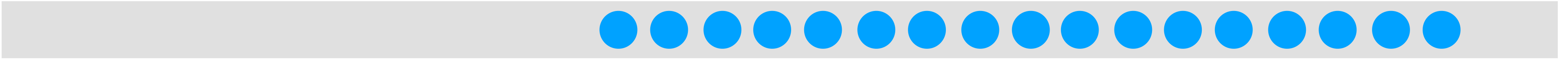


Time

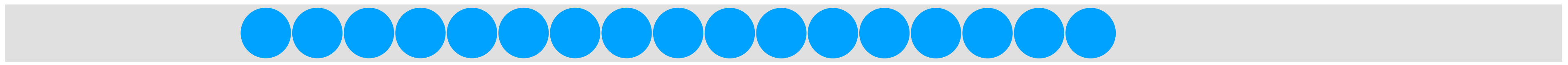
5th Percentile



Median



95th Percentile

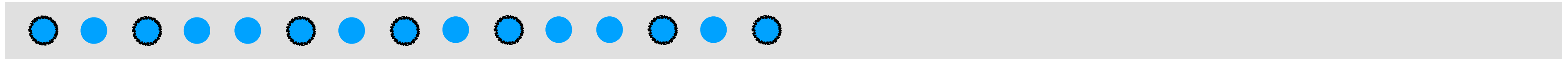


Sample Cells

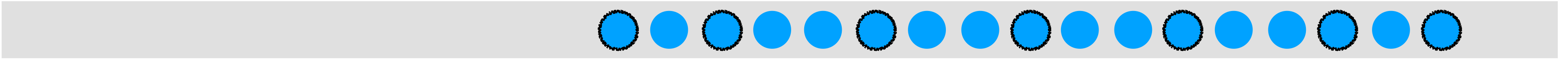


Time

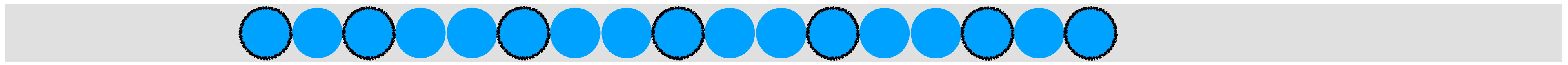
5th Percentile



Median



95th Percentile

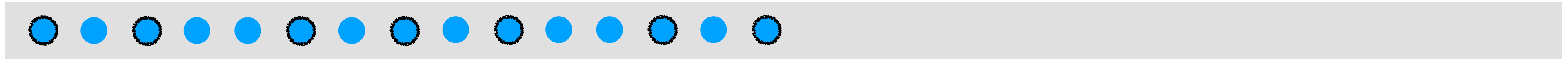


Sample Cells

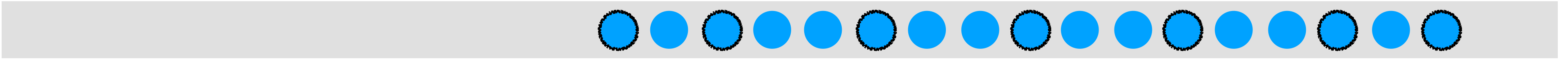


Time

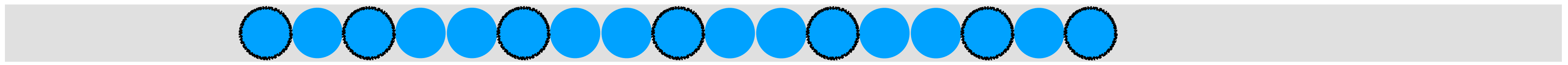
5th Percentile



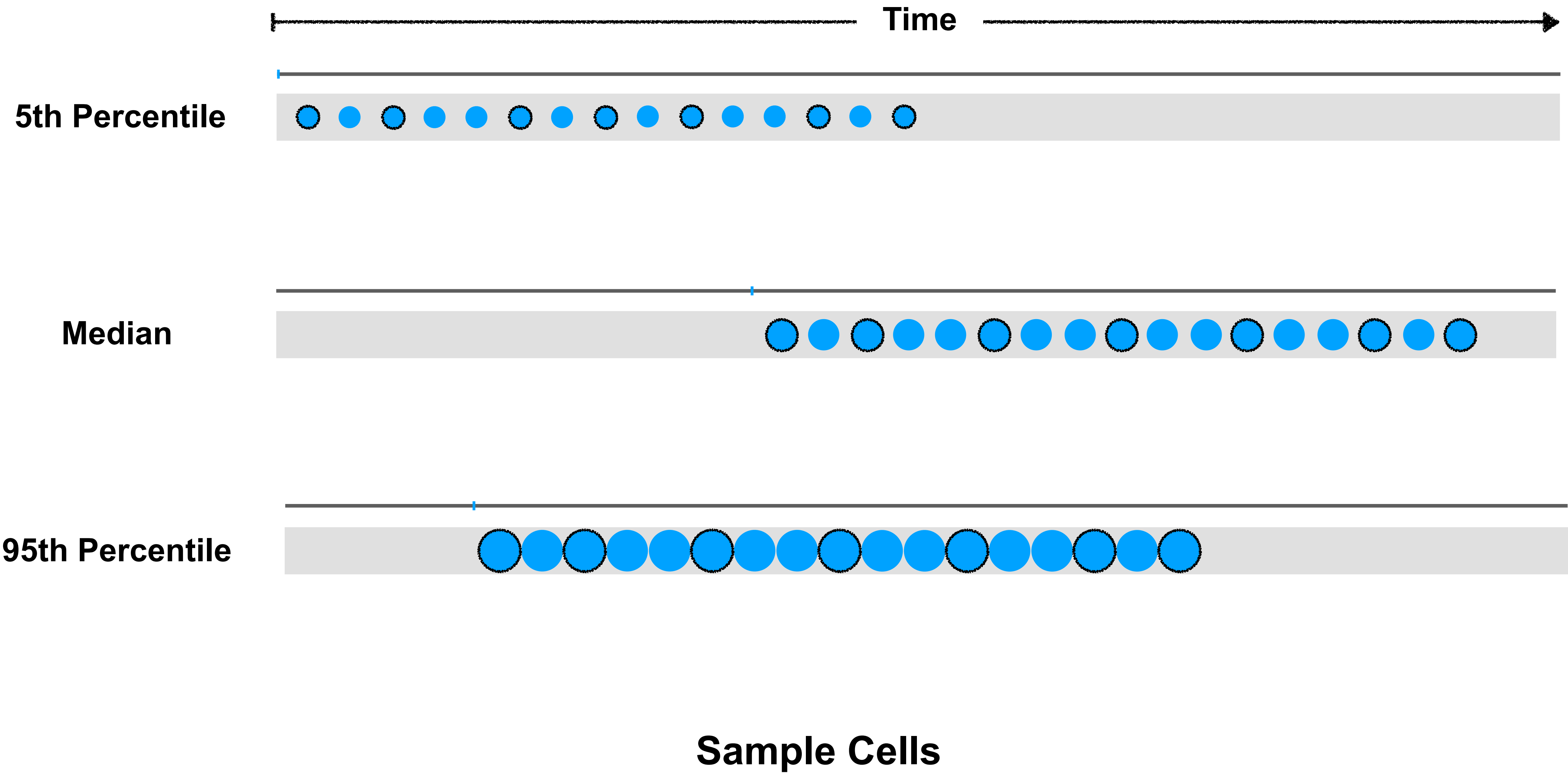
Median

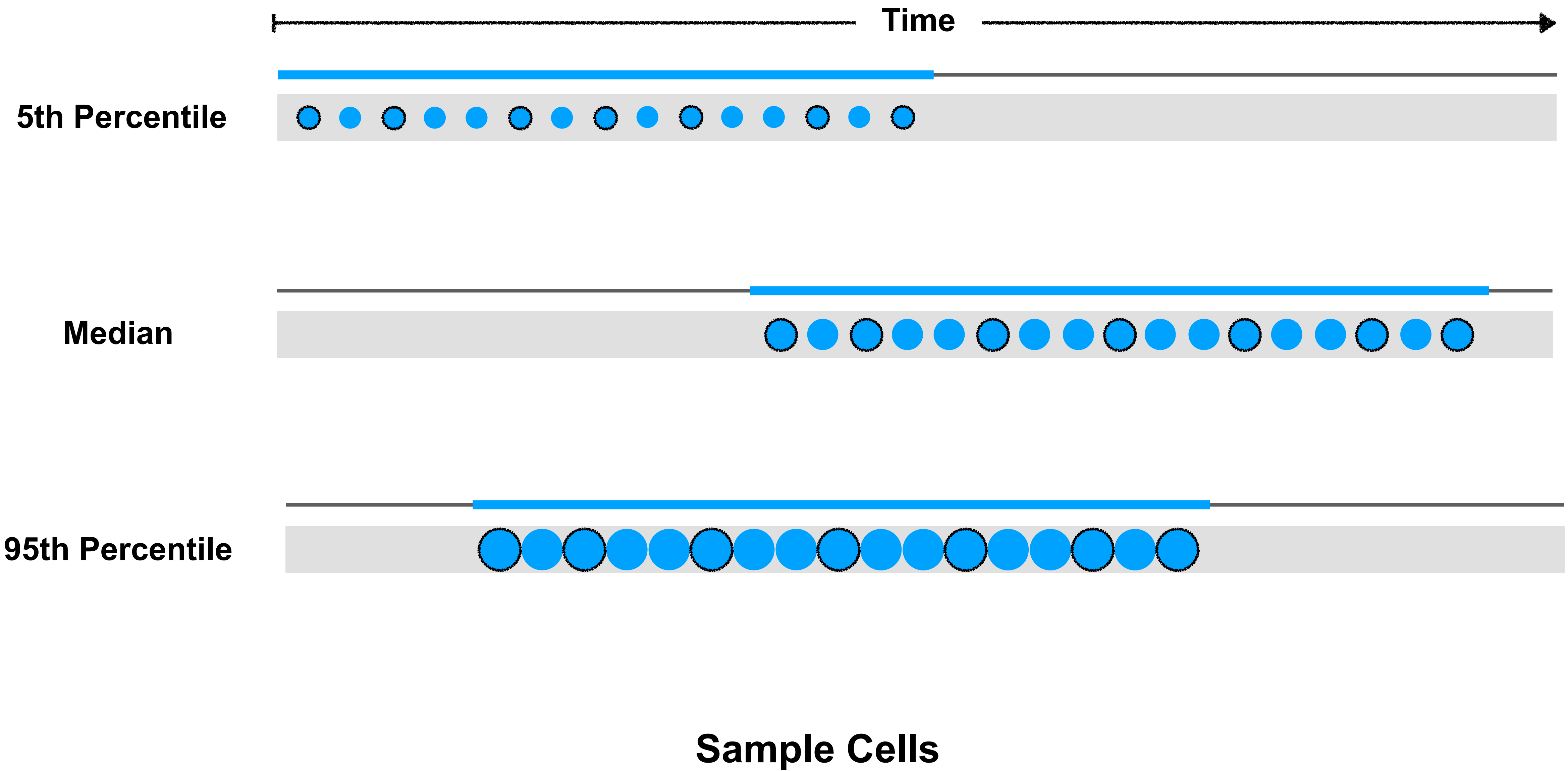


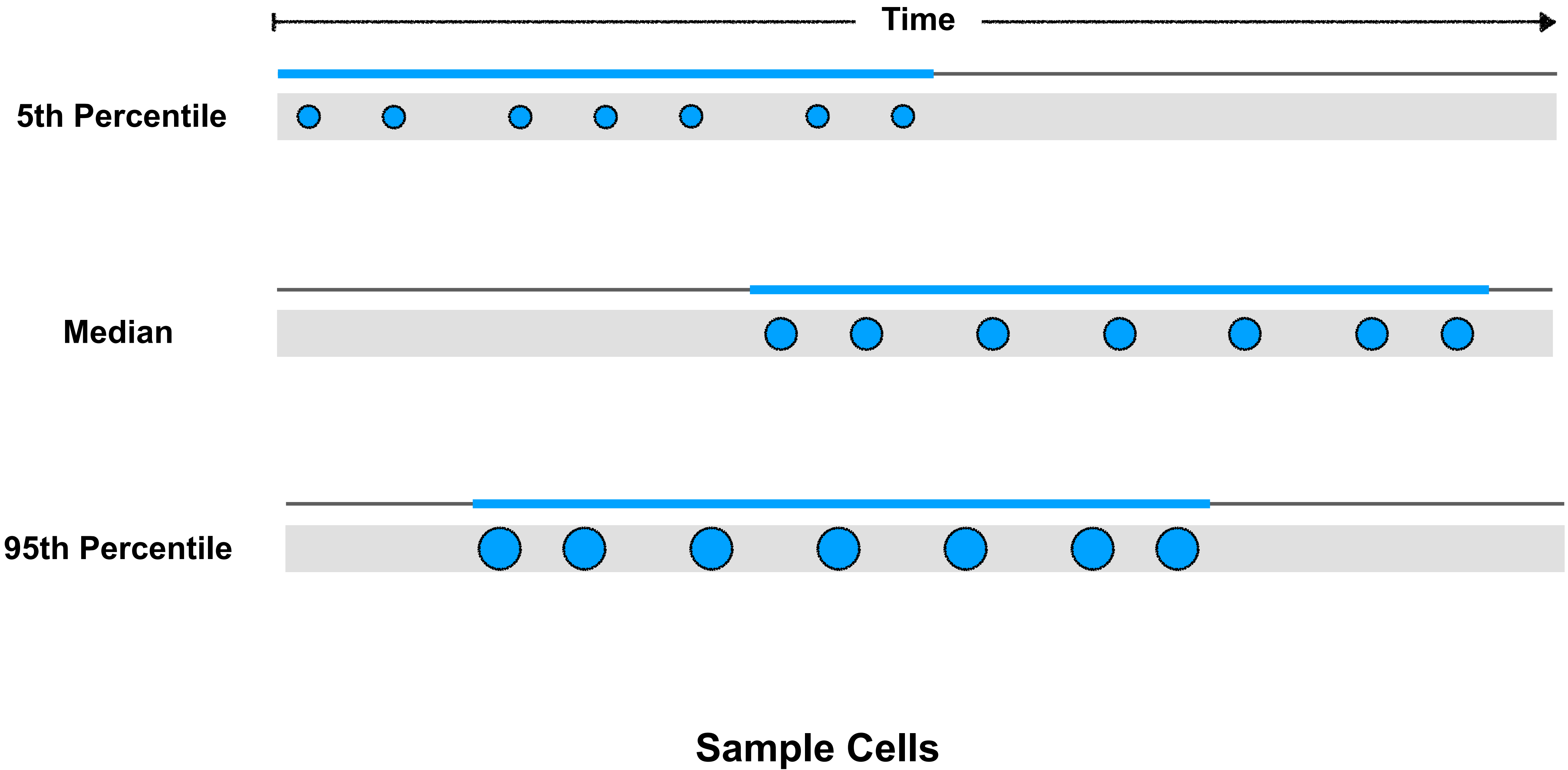
95th Percentile



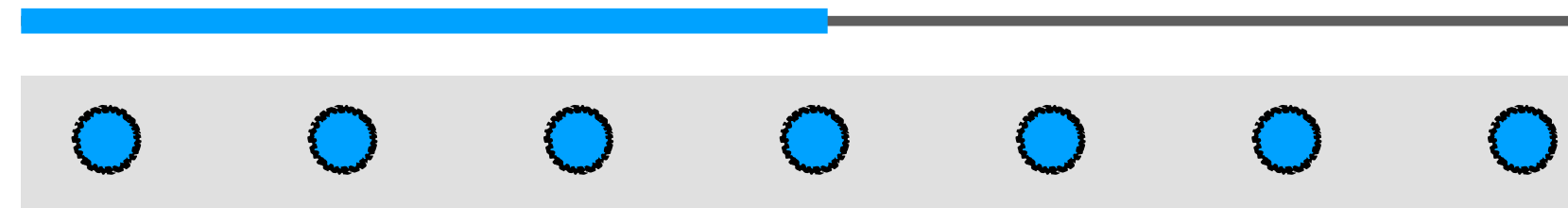
Sample Cells



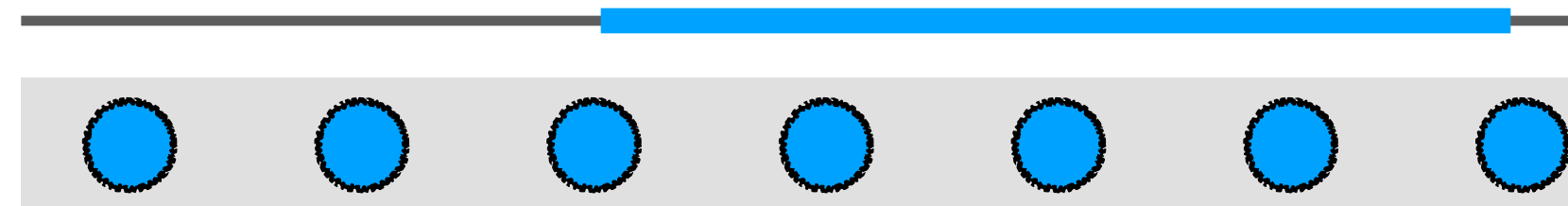




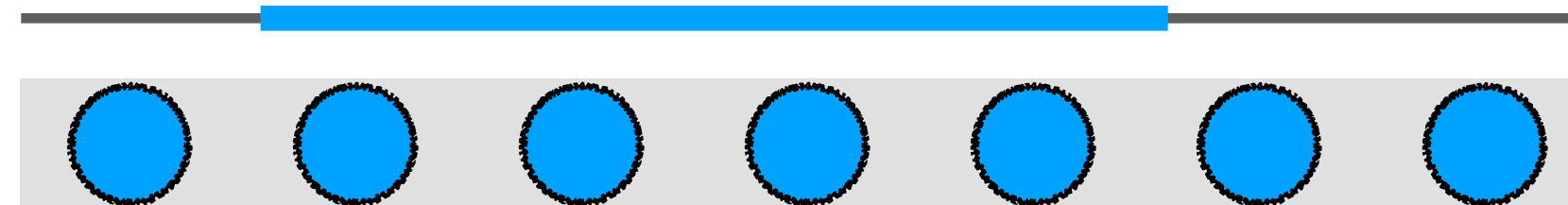
5th Percentile



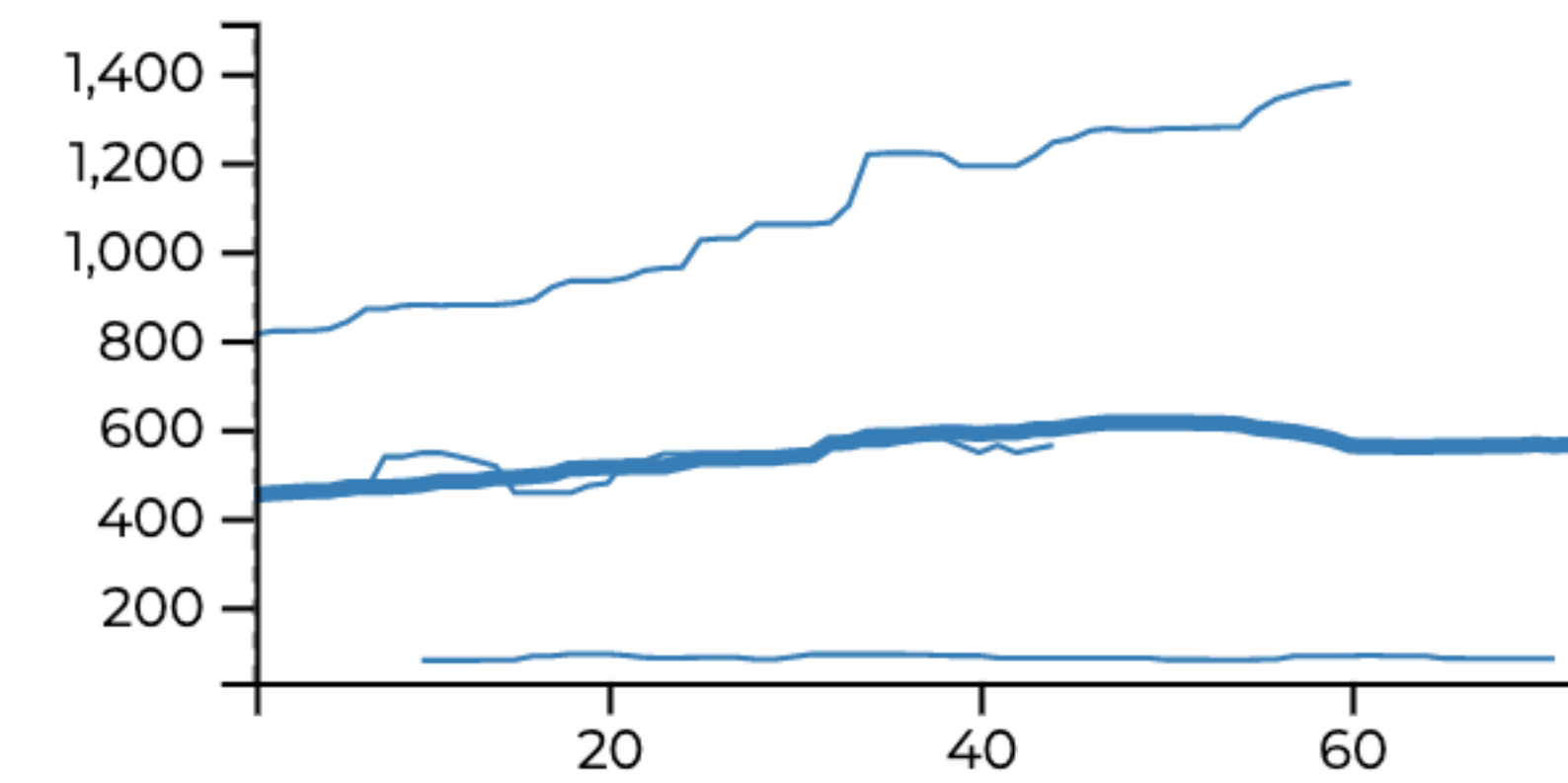
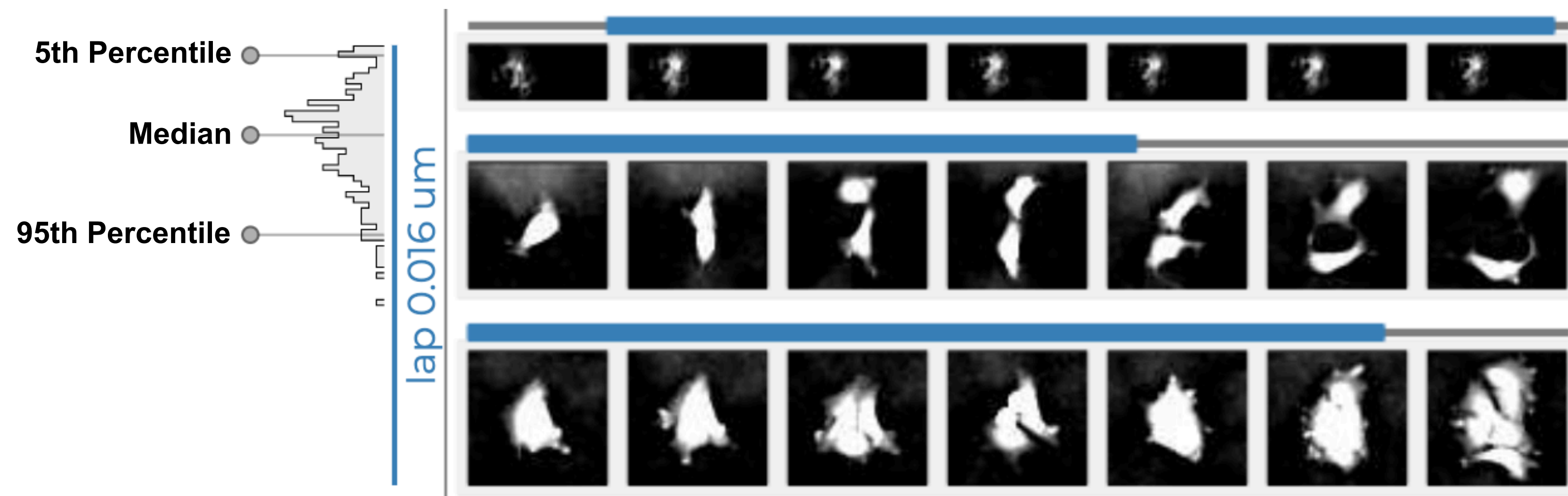
Median



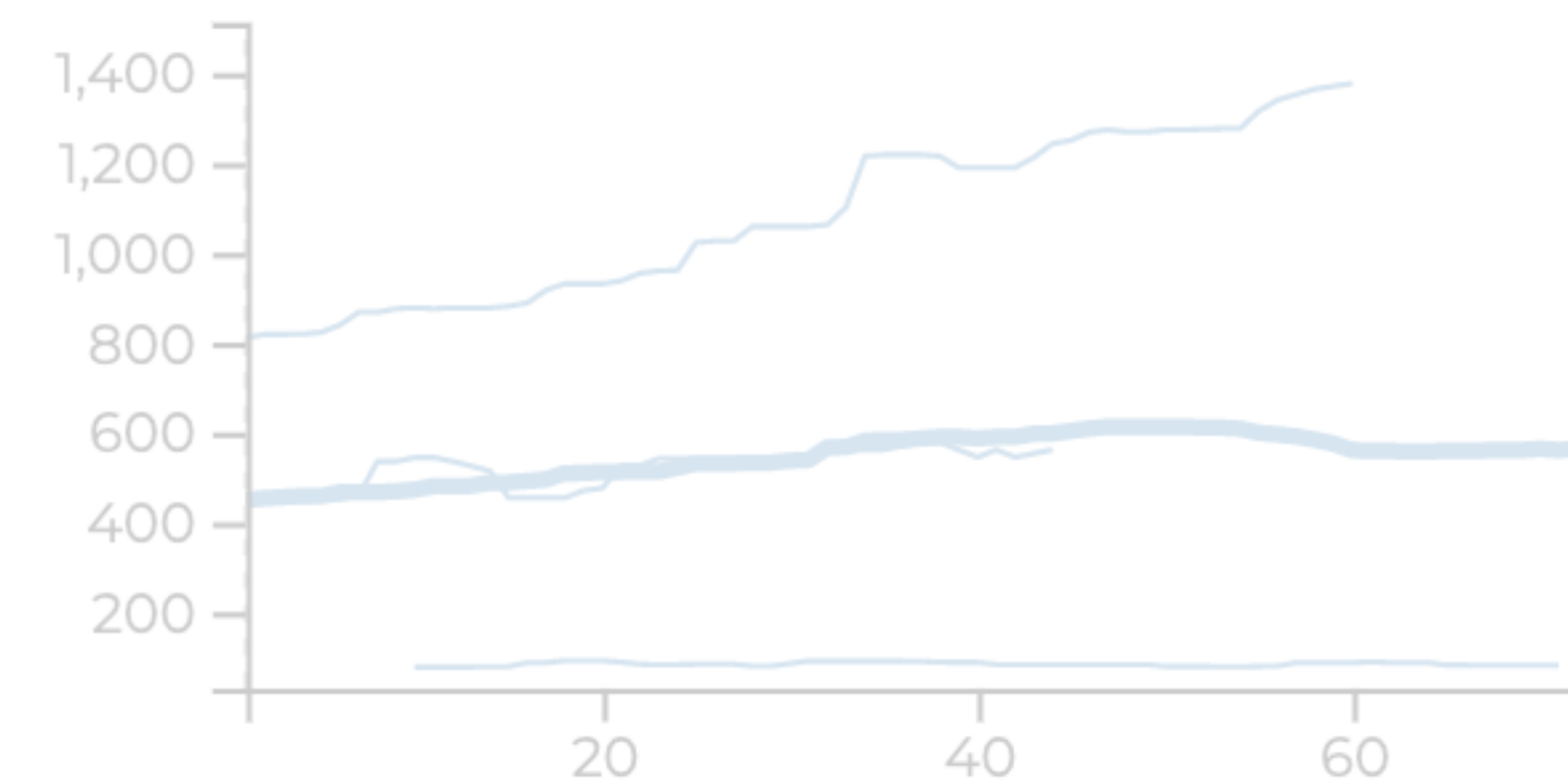
95th Percentile



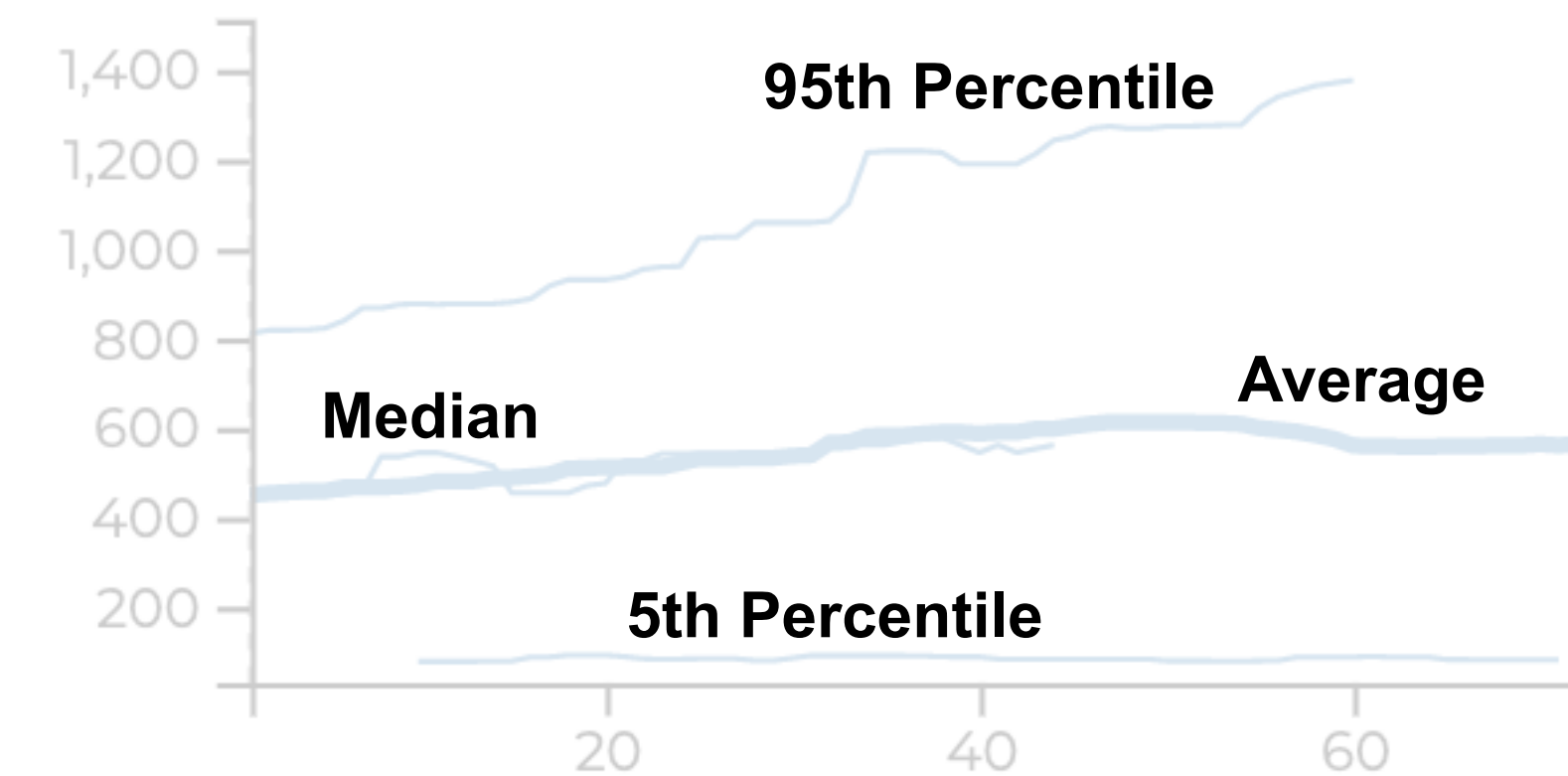
Align Cells



Final Display



Distribution of Mass



Mass Over Time

Demo

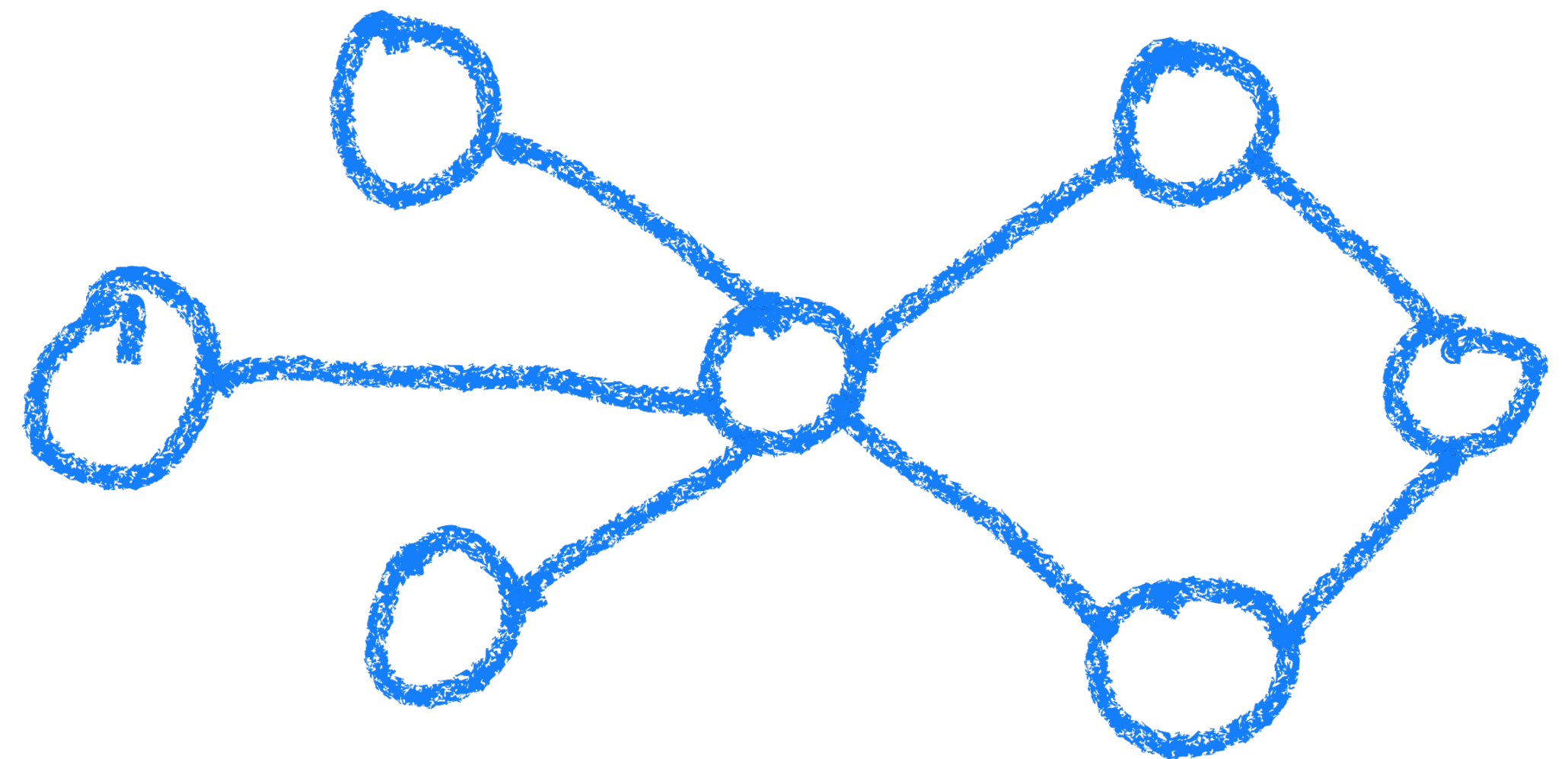
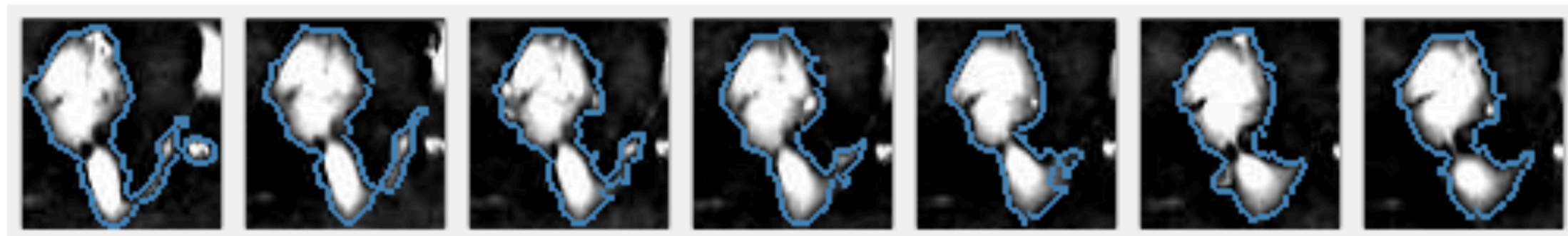
<https://loon.sci.utah.edu/>

Discussion

Criteria for applying exemplars

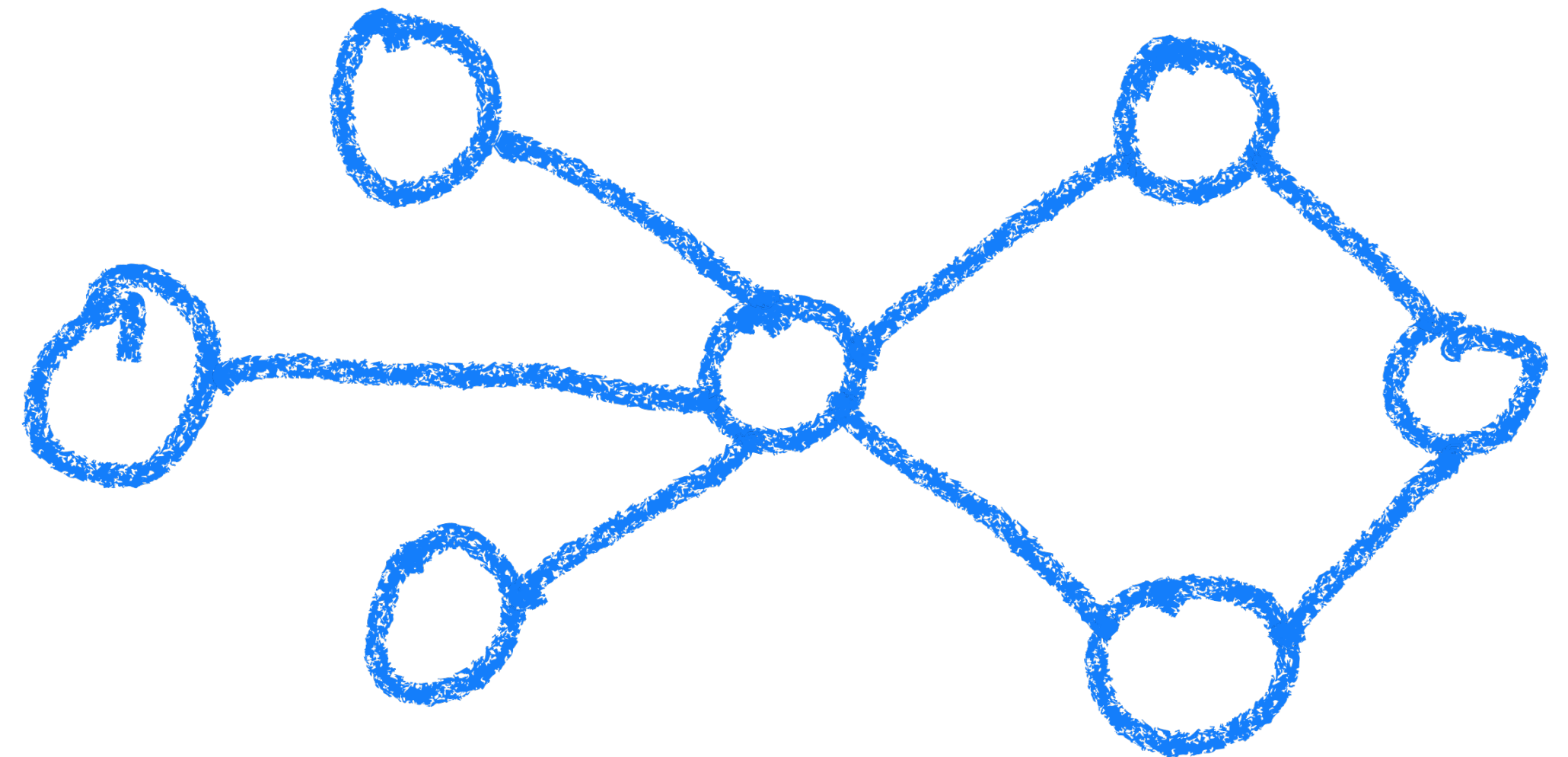
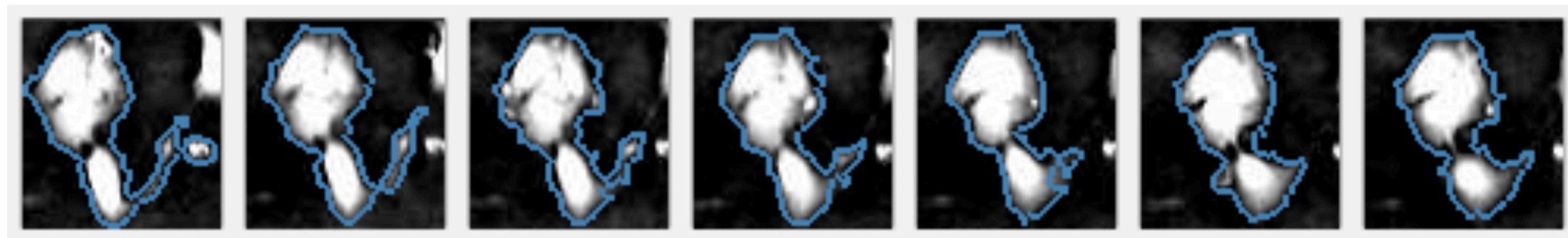
Criteria for applying exemplars

- **Rich contextual data that cannot be summarized**



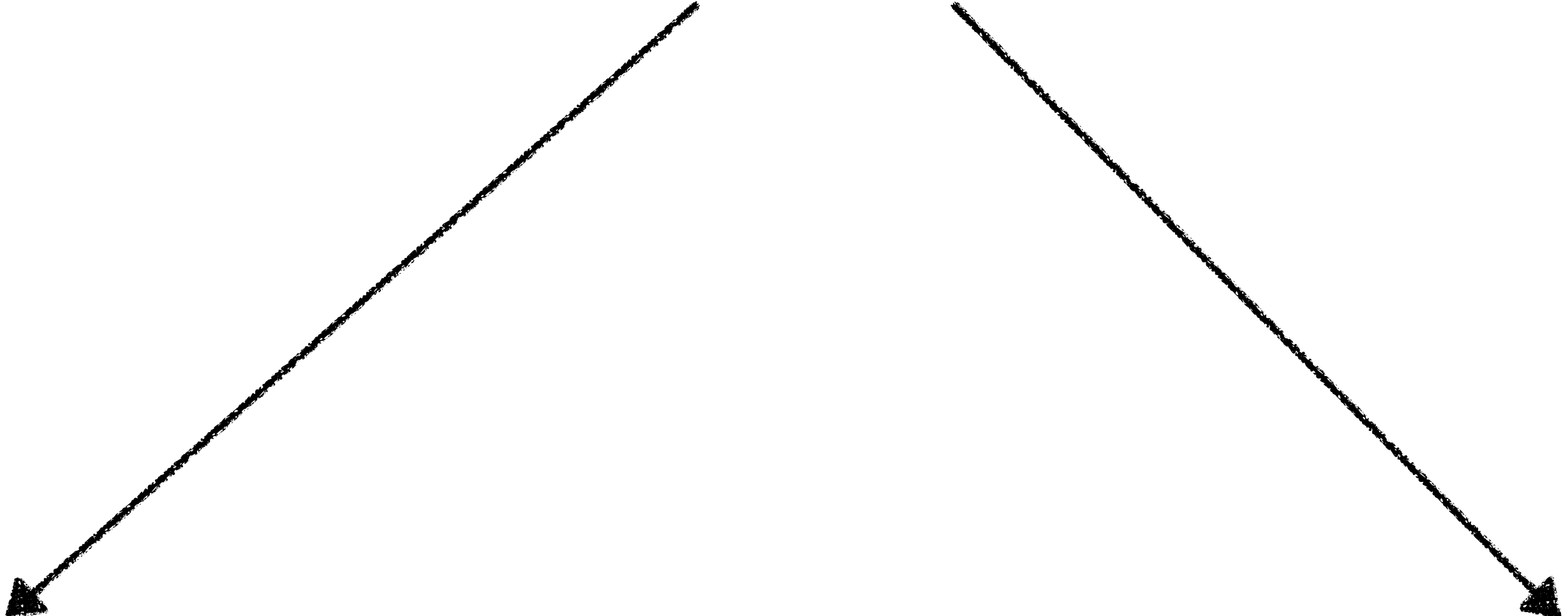
Criteria for applying exemplars

- **Rich contextual data that cannot be summarized**
- **Dataset is sufficiently large**



Future Work

Future Work



```
graph TD; A[Future Work] --> B[Apply the concept of exemplars to other situations]; A --> C[Develop new enhancements to Loon e.g. Cell Lineage]
```

**Apply the concept of
exemplars to other situations**

**Develop new enhancements to Loon
e.g. Cell Lineage**

Thank You!

Loon

Using Exemplars to Visualize Large Scale Microscopy Data

Devin Lange, Eddie Polanco, Robert Judson-Torres, Thomas Zangle, Alexander Lex

<http://loon.sci.utah.edu/>



visualization
design lab



Zangle Lab
Department of Chemical Engineering
THE UNIVERSITY OF UTAH



UNIVERSITY OF UTAH
HUNTSMAN
CANCER INSTITUTE



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UNIVERSITY OF UTAH