

Introduction to RNA Velocity Analysis

Hands on tour of the single cell analysis journey

Recap: Neutrophil analysis plan

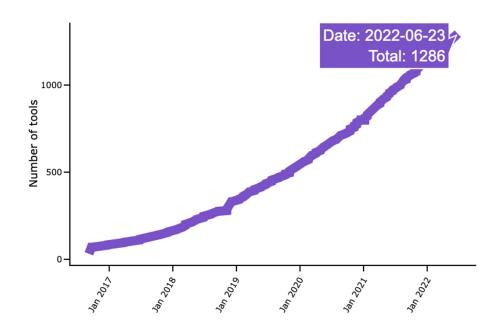
Our journey through analysis

Neutrophils have Neutrophils high ssue Cells separate Separate Neutrophils exist low UMI content into distinct neutrophils from at different stages intron retention dead/dying cells of maturation clusters rates Solution **Velocity** Include low Annotate cell Filter Map introns UMI barcodes background analysis clusters Tool Cell Ranger "force-Cell Ranger "include-**Loupe Browser Loupe Browser Community tools** cells" introns"



Approaching the Analysis Ecosystem

More than 1,000 tools!



https://www.scrna-tools.org/

- How do you choose?
 - Leverage your research question
 - Look to the literature
 - Citations
 - Reviews
 - Look at GitHub sites
 - Check for regular updates
 - Check for issues and responses
- 10x Analysis Guides
 - Introductions
 - Tutorials
 - Informatics blogs



RNA Velocity

Single-cell RNA-seq provides only static snapshots of cellular states at the moment of the measurement.

RNA velocity (<u>La Manno et al, 2018</u>; <u>Bergen et al. 2020</u>) can predict the direction and speed of movement of cells in transcriptome space.

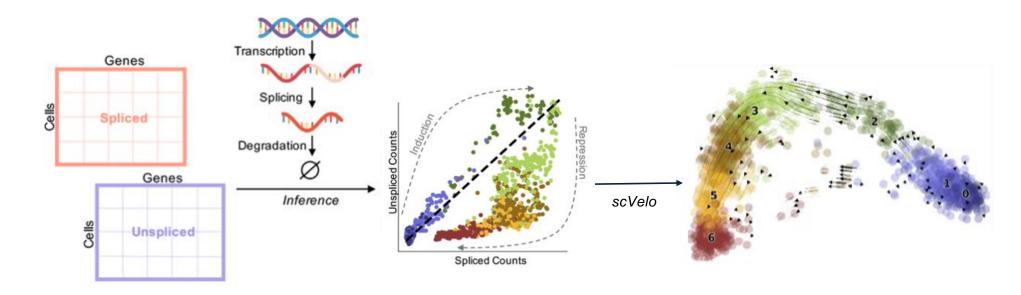
Application: analysis of cell dynamics → developmental biology, tissue regeneration, disease progression

Volker Bergen, https://www.youtube.com/watch?v=QWfd kSNPgk



How does RNA velocity work?

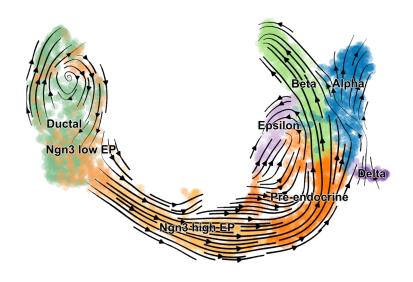
Estimation basis: the relative abundance of nascent (**unspliced**) and mature (**spliced**) mRNA \rightarrow rate of RNA splicing and degradation



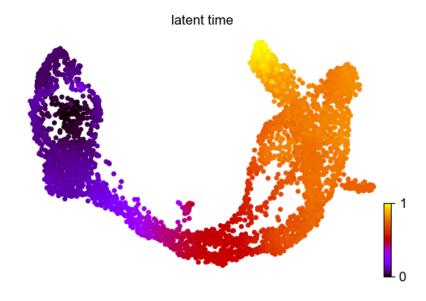
https://doi.org/10.1101/2022.02.12.480214



Example of scVelo results



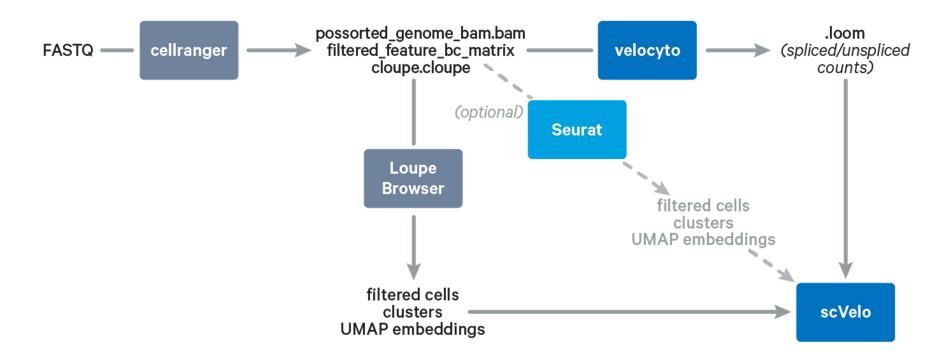
Endocrine development in the pancreas with lineage commitment to four major fates: α , β , δ and ϵ -cells.



The <u>latent time</u> represents the **cell's internal clock** and approximates the real time experienced by cells as they differentiate, based only on its transcriptional dynamics.



Velocity analysis using 10x data



https://www.10xgenomics.com/resources/analysis-guides/trajectory-analysis-using-10x-Genomics-single-cell-gene-expression-data

