Understanding COVID-19 with Single Cell Immune Profiling

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ABSTRACT

Scientists all around the world are coming together for a single goal – to find the cure for COVID-19; the novel coronavirus that has sent millions of people worldwide to hospitals and hundreds of thousands to their death. While scientists are trying to uncover the mysteries of the virus, 10X Genomics product lines help scientists achieve their goals. With the Single Cell Immune Profiling, scientists around the world study the immune response and antigen specificity of the virus. The Immune Profiling product line studies millions of T-Cells and B- Cells on a cell-by-cell basis. Manufacturing of product lines ensure that every product that reaches the scientists are consistent which allows for proper reproducibility.

INTRODUCTION

The Single Cell Immune Profiling, also known as SC5', is a product line from 10X Genomics that looks at the adaptive immune response and thousands of T and B cells. The product line looks at immune cell diversity, V(D)J recombination, and immune cell profiling. While sheltering-in-place is in effect, the role of manufacturing does not stop. The manufacturing team, which includes formulation, gel bead production, and functionalization must be able to produce consistent products that are shipped out to the scientists that are looking to uncover more information on the virus that causes COVID-19 virus.

REAGENT MANUFACTURING GOALS

- **Manufacturing Primers, Buffers, and other reagents for 10X Genomic product lines**
  - Following a batch record ensures that the product being formulated is accurate at all times. The same products made by different production associates must pass quality control in order to be sent to customers or used in house by the other teams.
- **Dispensing the newly formulated products to be packaged for customers**
  - Dispensing reagents on a large scale allows for a quick workflow which can then be sent to the packaging team to package the kits to be sent to customers.
- **Learning to revise a standard batch record for formulations**
  - Revisions to batch records lead to clearer and more consistent formulations of every product produced. Reducing uncertainty in older batch records can improve operational efficiency with good quality

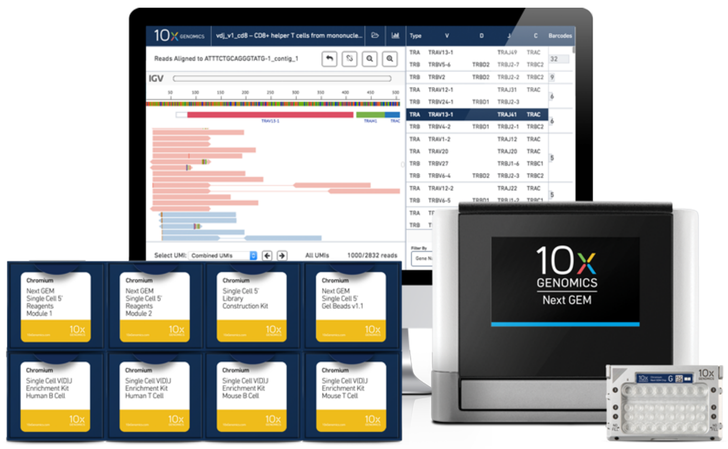

Figure 1. Single Cell Immune Profiling Kit with Chromium Controller The kit is sent out to scientists and uses a microfluidic chip to be read in the Chromium Controller, the instrument used to collect data.

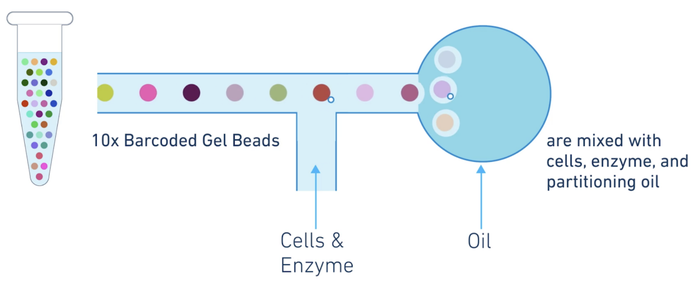

Figure 2. Formation of GEMs Gel Bead with the customer sample is encased in a partitioning oil. Each gel bead has their own unique barcode attached to it. The customer samples then attaches to the barcode and the gel bead dissolves. This leaves only the customer sample and the unique barcode left behind from the gel bead.

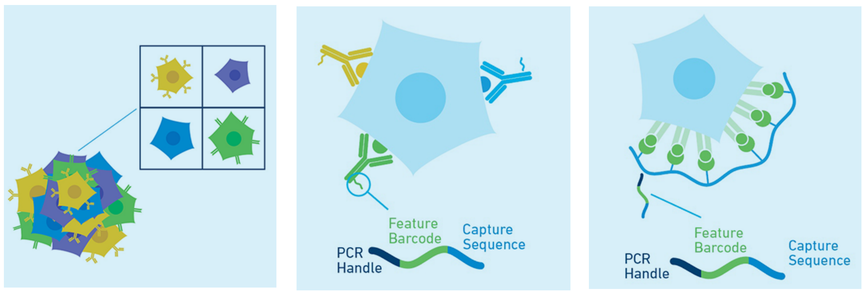

Figure 3A. Immune Repertoire and Gene Expression Looks at the collection of T and B Cells in humans and mice on a single cell level.

Figure 3B. Cell Surface Protein Can measure gene and cell surface protein expression on a single cell by using antibodies with barcodes.

Figure 3C Antigen Specificity Uses a barcoded peptide-MHC (pMHC) to help distinguish antigen specificity in T-Cells.

Research Using Single Cell Immune Profiling (scRNA-seq) to Learn About COVID-19

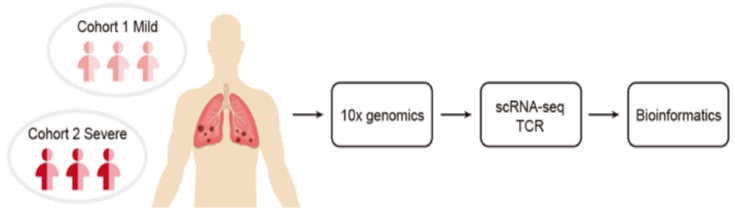

Figure 5. A Figure from Liao et. al., 2020 paper. The schematic shows how their experiment was outlined. They used 10X SC5' for scRNA/scTCR sequencing. The paper highlights the microenvironment of COVID-19 infected lungs, inflammatory macrophages replacing FABP4⁺ macrophages, and how expanded CD8⁺ T-Cells is critical for viral control.

	AGE	SEX	RACE	Smoking Status	Single Cell Number
Donor1	63	F	African American	Never	5370
Donor2	55	M	Asian	Former	3813
Donor3	29	F	African American	Never	5150
Donor4	57	F	African American	Never	5142
Donor5	49	F	White	Active	5275
Donor6	22	F	African American	Never	4208
Donor7	47	F	White	Active	7446
Donor8	21	M	African American	Never	6730

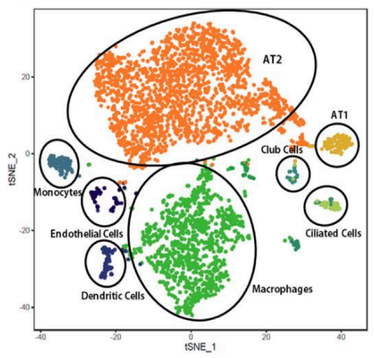

Figure 5. Data from the Zhoa et. al. 2020 paper. Single Cell analysis in healthy lungs. The table shows the characteristics of the lung transplant donors. The cluster map used an R package to analyze the samples. They used the 10X technology to study ACE2 receptors.

CONCLUSIONS

- **Single Cell Immune Profiling can be used when learning more about infectious diseases like COVID-19.**
- **It is evident that there needs to be more research as to how the virus infects the body.**
- **The role of manufacturing team cannot stop because the scientists doing the research must have their products to give the people information regarding their health and safety.**

FUTURE DIRECTIONS

Formulating reagents for other 10X Genomic product lines that can be used in studying more about COVID-19 as well as other fields of research.

References

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- Zhao, Y., Zhao, Z., Wang, Y., Zhou, Y., Ma, Y., & Zuo, W. (2020). Single-cell RNA expression profiling of ACE2, the receptor of SARS-CoV-2. *BioRxiv*. doi:10.1101/2020.01.26.919985
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