The Boeckh Group

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About Me

- Education: recent graduate of Shoreline Community College's high school biomanufacturing program, now pursuing bachelor's at the University of Washington Bothell
- Interests: chemistry, biotechnology, immunology, computer science
- Motivation to participate in LabLaunch: I wanted to explore career options in life science that do not require a PhD to continue evaluating what paths could be a good fit for me.

Overview of the Boeckh Group

Both laboratory and clinical work happens in the Boeckh group. On the lab side, there are eight people, and on the clinical side there are six. Michael Boeckh MD, PhD is the principal investigator.

Research and Mission

The Boeckh group primarily researches infectious diseases caused by cytomegalovirus (CMV) and respiratory viruses in patients who are immunosuppressed due to receiving a hematopoietic stem cell transplant. One ongoing project is investigating the differences in humoral immunity between patients with respiratory syncytial virus (RSV) that progress to a lower respiratory infection and patients that only experience an upper respiratory infection. This research supports Fred Hutch's mission to cure and prevent infectious disease by giving us a better understanding of what factors contribute to patients experiencing adverse effects from viral infections.

Infectious Disease Science Biorepository

The Boeckh group also manages the Infectious Disease Science (IDS) biorepository, which stores thousands of leftover clinical and research samples from infectious disease patients for use in future research. These samples include plasma, serum, bronchoalveolar lavage fluid, cerebrospinal fluid, and more.

There are several ways the IDS biorepository enables the exploration of research questions that would not be possible otherwise. By storing samples from as far back as 1977, the repository acts as a time machine for observing how pathogens and treatments have changed over time. Older serum samples from the biorepository enabled Jesse Bloom's lab to study coronavirus evolution. Additionally, it stores sample types that are unusual to find in other biorepositories, such as bronchoalveolar lavage (BAL) samples. Some of these sample types may have been considered useless in the past, but are essential to current investigations in the field of infectious disease science.

The IDS biorepository is a resource that any investigator can use at Fred Hutch to support their research, with IRB approval.

Figure 1: Some of the freezers in the IDS Biorepository

Tasks Performed by the Boeckh Group

Blood Component Isolation

Lab aides in the Boeckh group often isolate components from whole blood for use in current research and storage in the IDS biorepository. This includes serum, plasma, peripheral blood stem cells (PBSCs) and peripheral blood mononuclear cells (PBMCs).

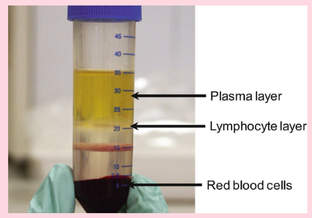

Figure 2: A Leucosep tube used in PBMC isolation. Image credit Casey W. Buller and Stephen O. Mathew

VirScan

VirScan tests serum to provide information about the humoral immunity of a patient, and therefore information about past infections they've experienced.

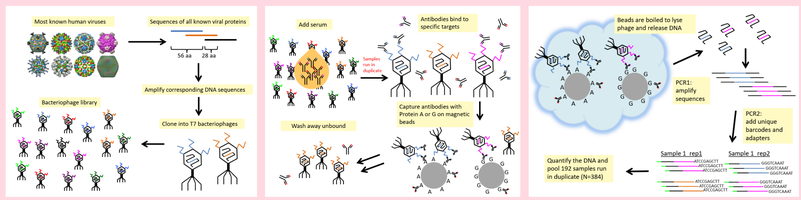

Figure 3: Several steps in the VirScan assay. Image credit to Terry Stevens-Ayers

What I Did This Summer

IDS Biorepository Work

- Inventoried samples of serum, cerebrospinal fluid and bronchoalveolar lavage fluid that were tested for CMV for incorporation into the IDS biorepository
- Consolidated samples of plasma and PBMCs in the IDS biorepository for a study of how human herpesvirus 6 is associated with central nervous system dysfunction in immunocompromised patients
- Shadowed lab aides as they processed whole blood from HCT patients to isolate PBMCs, plasma and serum
- Presented a summary of a Boeckh group publication using BALs from the repository to explore quantitative PCR as a diagnostic tool for CMV pneumonia

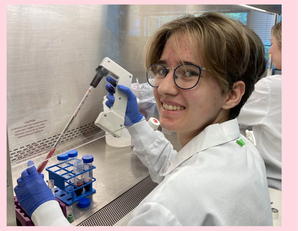

Figure 4: Isolating PBMCs from healthy blood

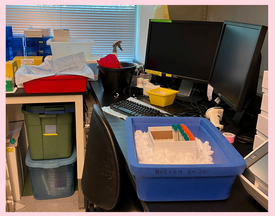

Figure 5: Inventorying leftover plasma, BAL and CSF samples from UW Virology

Learned About Infectious Disease Research

- Stages of immune system recovery after a hematopoietic stem cell transplant, and how different stages leave a patient vulnerable to different pathogens
- The biology behind the VirScan assay, and how it can be applied to investigate various research questions
- Attended scientific talks from other groups in the infectious disease science division to better understand current research in the field

Highlight: CMV Testing Project

- Isolated PBMCs from healthy donor blood
- Performed an intracellular cytokine staining assay to identify CD4 and CD8 T-cells that produce cytokines when stimulated by CMV protein pp65
  - Control groups: CEFX to see if the cells can be stimulated; DMSO to determine what the background looks like with no stimulation
- Learned about flow cytometry mechanics, panel design and data analysis
- Used flow cytometry on the stained T-cells to gather data about their CMV response

Figure 6: Flow cytometry of PMBCs stained for surface receptors, viability and cytokines

CMV Testing Project Data Analysis

- Each sample needs to be "gated" to identify the cell population of interest (in this case, CD4+ and CD8+ T-cells)
- This process involves multiple steps of filtering out "irrelevant" populations, such as dead cells and monocytes, as well as debris and antibody aggregates that create noise in the data
- To find the percentage of T-cells expressing the cytokines IL-2 and INFg, the background (DMSO) needs to be subtracted from the raw values. When the background was subtracted from the sample shown in Figure 7, there was no significant cytokine presence above background, suggesting that the individual this sample came from does not have CMV

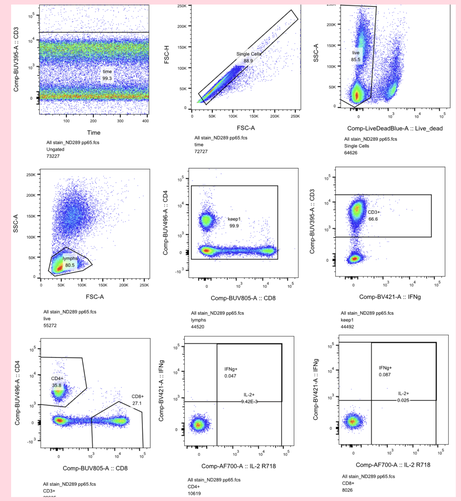

Figure 7: Gating tree for the pp65 sample

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