Hemoglobin: the amount of hemoglobin in whole blood.

Mean cell hemoglobin concentration: the average concentration of hemoglobin in a given volume of RBC.

Mean cell hemoglobin concentration: the average volume of a red blood cell.

Mean corpuscular hemoglobin: the amount of hemoglobin in an average red blood cell.

Hematocrit: volume RBC/volume whole blood

Red blood cell distribution width: standard error of the cell volume/mean cell volume.

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| 3803\_1 | - Gene3803\_1 affects all WBC types (decreases) in a way that all differential counts don't change too much, except for Neutrophil and Lymphocyte.  - Platelet count on its own.  - Mean cell volume increase but hematocrit doesn't change so # RBC decreases. Less cell but same amount of hemoglobin -> amount of hemoglobin per RBC increases. |

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| 1550\_1 | Not so clear |
| 1796\_1 | - Three RBC measurements same as 1798\_1.  - LUC count+diff. count decreases, confident. Monocytes not confident, same argument as 727\_1. |
| 1797\_1 | - Lymphocyte count increases -> WBC increases because most of WBC are lymphocytes. But diff. count not changing as the numerator and denominator increase similarly.  The rest is not clear. |
| 1798\_1 | WARNING: wrong signs. Should be hematocrit (–), mean cell volume (–).  - Only affects RBC type.  - Mean cell volume decreases -> hematocrit decreases -> MCHC increases as hemoglobin in whole blood doesn't change. |
| 1799\_1 | - Mean cell volume increase but # RBC doesn't change -> total volume of RBC increases i.e. hematocrit increases.  - Amount of hemoglobin per cell decreases (mean corpuscular decreases) -> concentration in RBC decreases.  - Draw a DAG? Same problem as DAG on the right on poster. |
| 3157\_1 | - Same argument as 3621\_1 and 727\_1 for lymphocytes diff. count. Eosinophil confident. |
| \*3621\_1 | - This is an example of differential count going down while the raw count goes up. Monocytes very sensitive to small change (small scale).  - Monocytes count increases, but monocytes diff. count decreases. LUC diff. count increases but the raw count does not change. So something else is increasing, but not enough to be found significant.  - All RBC type measurements change in the same direction.  - # RBC decreases and mean cell volume also decreases -> hematocrit decreases.  - Hemoglobin decreases enough so that mean corpuscular hemoglobin also decreases even if the # RBC decreases and the mean cell volume decreased. So does the concentration in whole blood. |
| 3805\_1 | - LUC raw count increases -> LUC diff. count increases. Confident with that as both same direction.  - Mean cell volume increases -> MCHC decreases since the total amount of hemoglobin does not change. |
| 3887\_1 | Not clear |
| 4045\_1 | - LUC diff. count decreases but not raw count. Same argument as 727\_1.  - Mean platelet volume on it's own. |
| 4047\_1 | - Mean cell volume increases, so the total volume of RBC increases -> hematocrit increases.  - Mean platelet volume on it's own. |
| \*727\_1 | - Raw count of monocytes did not increase, but differential count did increase meaning that all or some other WBC may have decreased, but not enough to be found significant.  - Since the # of RBC stays the same and hemoglobin does not change, this implies that the average amount of hemoglobin in each cell is decreasing, and so does the concentration in RBC. However, this change is not large enough to be reflected in the overall hemoglobin concentration (which consider whole blood). |

Key points

* Three main categories measurements: red blood cell, white blood cell, and platelet. Interpreted separately.
* Platelets seem to be on their own, sometimes appearing with RBC only (1798\_1) or WBC only (3157\_1) or with both.
* A lot of those phenotypic measurements are related by construction.
* We are more confident in drawing conclusion (causal interpretation) when the cell count and the differential cell count are going in the same direction.
* We are never certain of the pathway from one gene to a significant phenotype.

Sandwich estimator:

* Used to account for heteroscedasticity in OLS (and other) regression models.
* New term G added in calculation for var(beta\_OLS) in order to take into account variance heterogeneity.
* New variance term calculated as (X­­TX)-1XTGX(XTX)-1
* Can be used to account for cluster effect, i.e. observations within clusters are dependent, observations outside of clusters are independent.
* Terms within the matrix G are grouped together to estimate this cluster effect.
* Under regularity conditions yields variances for the MLE that are asymptotically efficient.