# Finding graphical correlations between $\Theta$ and CD4 T-cell levels in different HIV-1 progressor groups

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BIOL 368
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# Outline

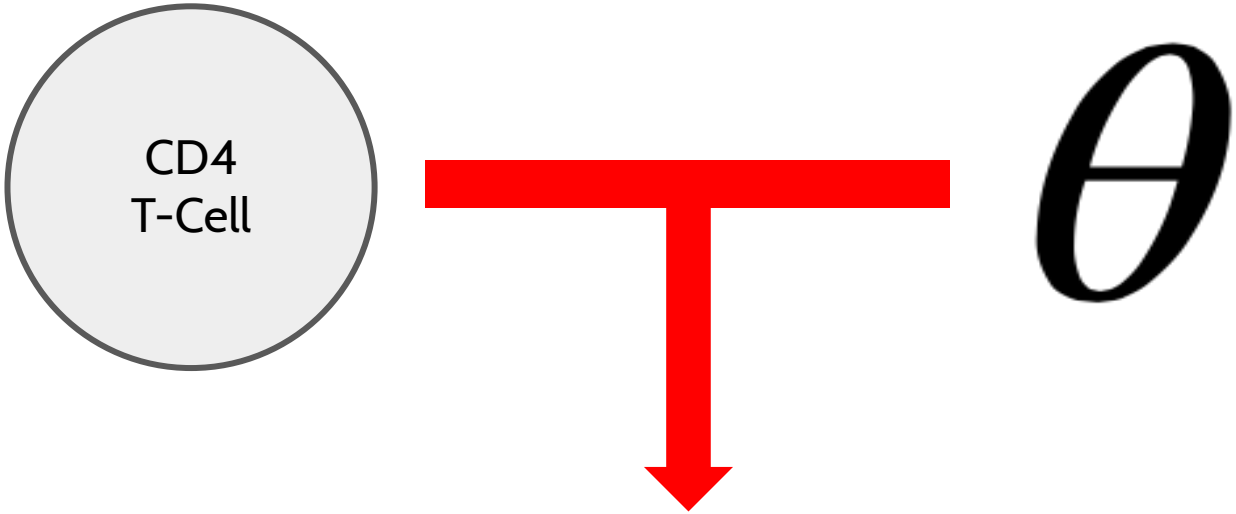
- **Markham *et. al*. (1998) found that higher levels of genetic divergence in HIV-1 variants were associated with greater declines in CD4 T-cell levels.**
- Θ and CD4 T-cell levels were plotted against each other within each progressor group.
- No groups had “strong” correlations, except Subject 14, who had a “relatively strong” correlation.
- Non-progressor group data showed a **direct** relationship, rather than an **inverse** relationship.
- The data was supported by our model, with the exception of non-progressors who show sustained CD4 T-cell levels.

Gaardbo *et. al.*, 2012

# As genetic divergence increases, CD4 T-cell levels decrease.

- Those in the rapid progressor group lost, on average, 349 T-cells per year (Markham *et. al.*, 1998).
- High mutation rates allow for fast adaptation in a host, which makes the HIV-1 virus hard to "cure."
- Θ represents genetic divergence, or how clones have changed through time.
- With more genetic variability comes more immediate T-cell loss.

# Ultimate Goal




Graphical correlation?

# Hypotheses

- **Null**: There is not an inverse relationship between Θ vs. CD4 T-cell levels in the HIV-1 patients in the study.
- **Alternate**: There is an inverse relationship between Θ vs. CD4 T-cell levels in the HIV-1 patients in the study.
- If the p-value ≤ 0.05, we will reject the null hypothesis.

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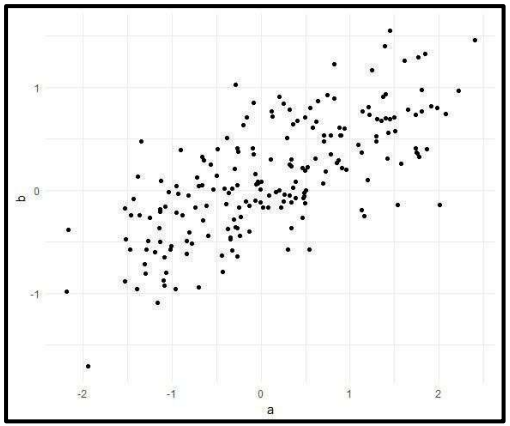
# Comparing Θ and CD4 T-cell levels

- Created scatterplots of Θ vs. CD4 T-cell levels in Microsoft Excel and placed regression lines and $R^2$ on each graph.
- Deleted data points in which Θ values were not recorded.
- Clustered sequence alignment and phylogenetic tree created for Subject 14.
- Utilized LINEST and FDIST on Excel for statistical analyses of linear regressions.

| Θ | CD4 |
|---|---|
| 2.980 | 749 |
| 6.445 | 768 |
| 8.535 | 648 |
| 4.305 | 552 |
| 2.980 | 698 |
| 2.828 | 405 |
| 2.121 | 223 |
| 3.867 | 351 |
| 5.031 | 387 |
| 7.777 | 471 |
| 8.837 | 399 |
| 8.463 | 556 |
| 9.898 | 1072 |
| 8.095 | 740 |
| 5.302 | 333 |
| 7.070 | 273 |
| 8.484 | 312 |



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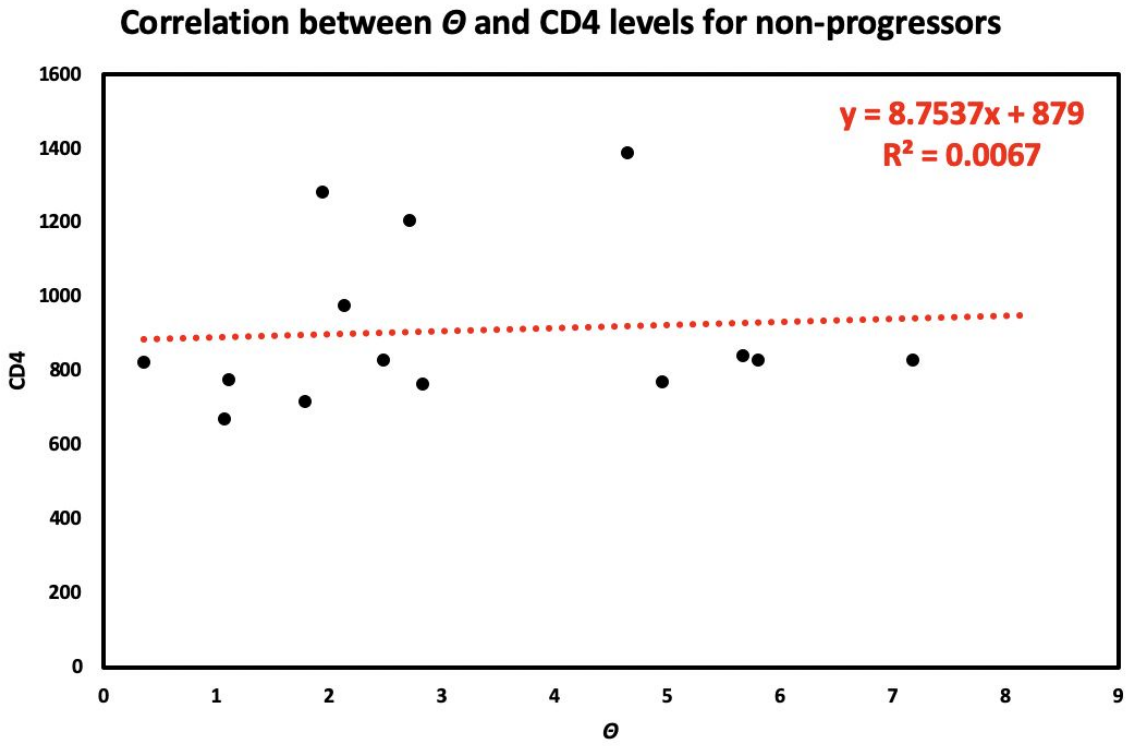
# Non-progressor data indicates a slight direct relationship.

**P-value = 0.936**

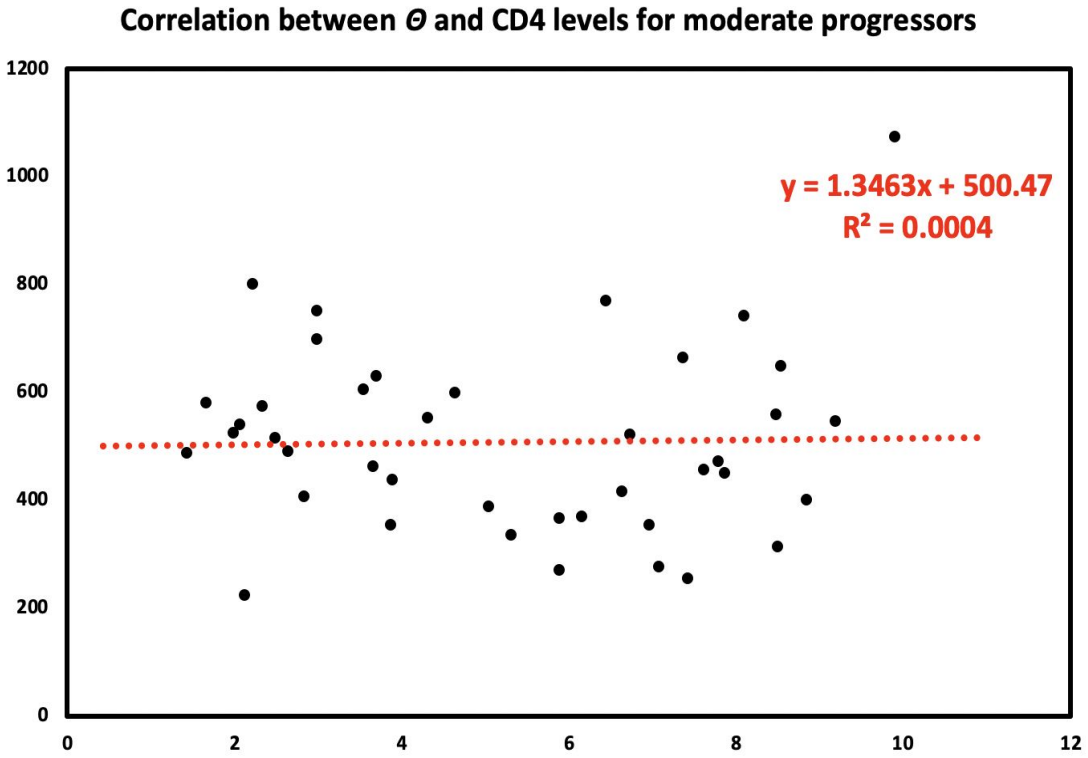
P>0.05, so we fail to reject the null. There is not significant statistical evidence to say that there is an inverse relationship.



# Moderate progressors show no correlation between variables.

**P-value = 0.903**

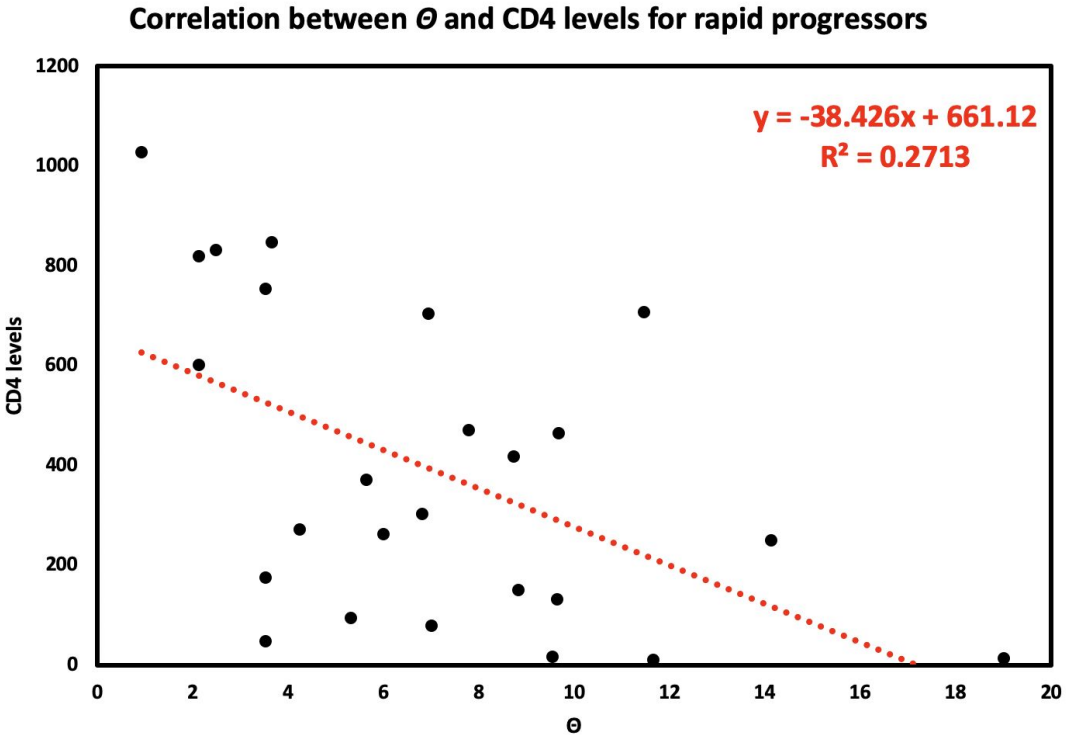
P>0.05, so we fail to reject the null.
There is not significant statistical evidence to say that there is an inverse relationship.



# A weak correlation between Θ and CD4 T-cell values exists in rapid progressors.

**P-value = 0.007**

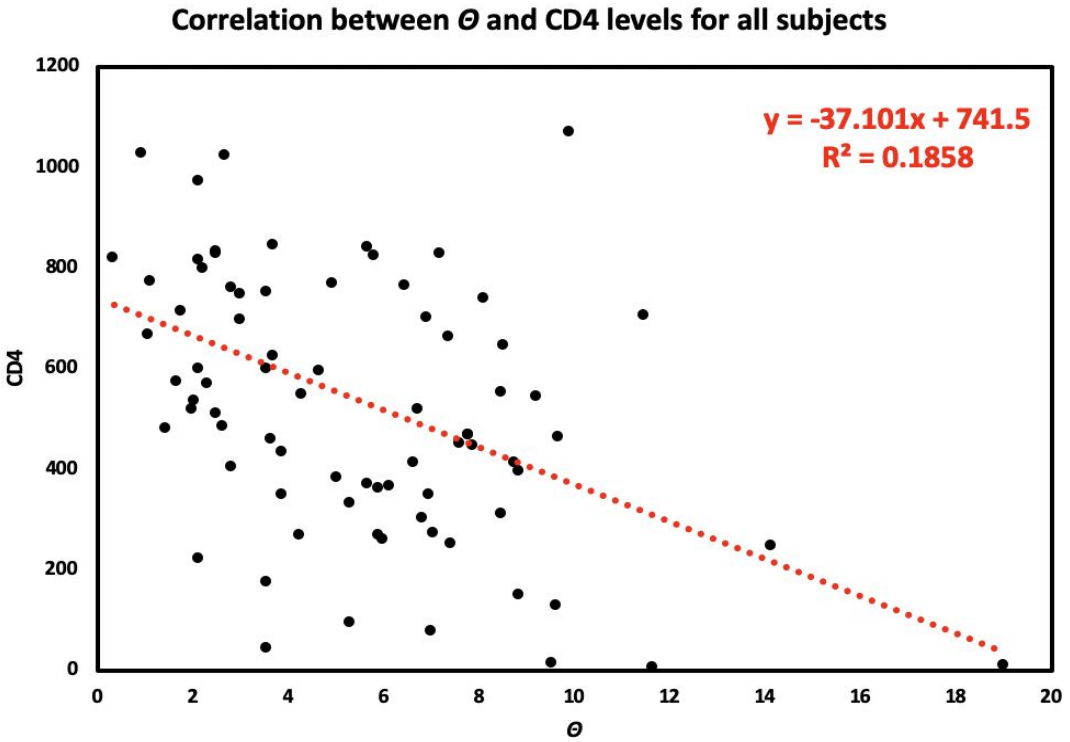
P<0.05, so we reject the null and accept the alternate.
There is significant statistical evidence to say that there is an inverse relationship.



# Though, for all subjects and their data, there is a weak correlation and an inverse relationship.

**P-value = $6.57 \times 10^{-5}$**

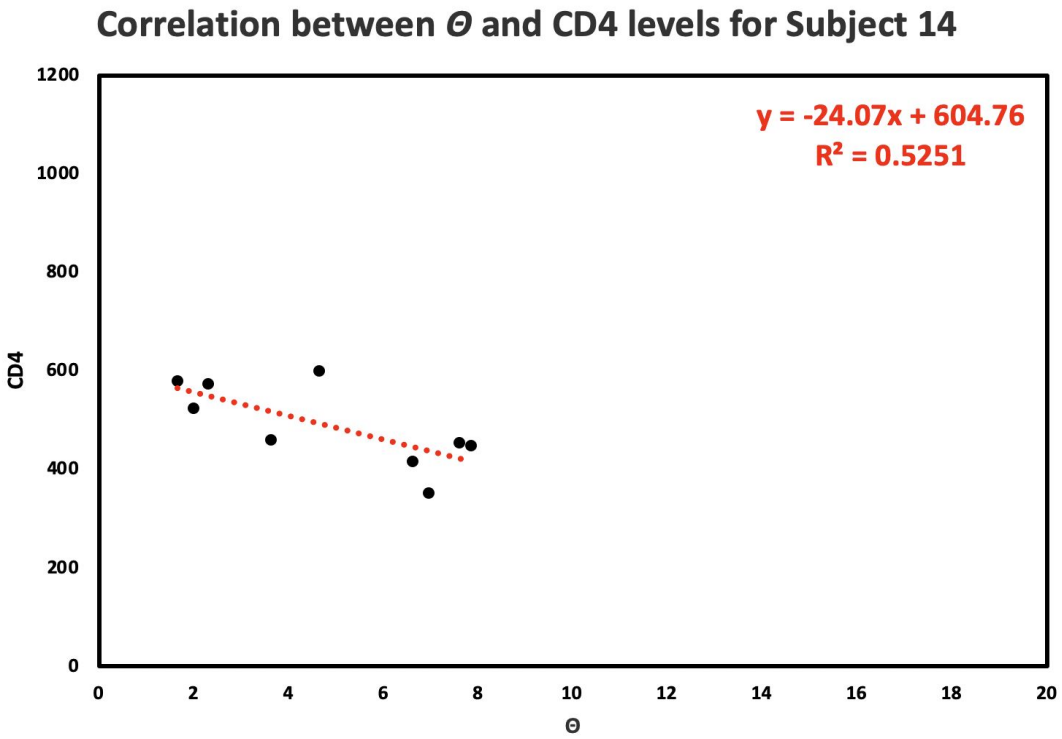
P<0.05, so we reject the null and accept the alternate.
There is significant statistical evidence to say that there is an inverse relationship.



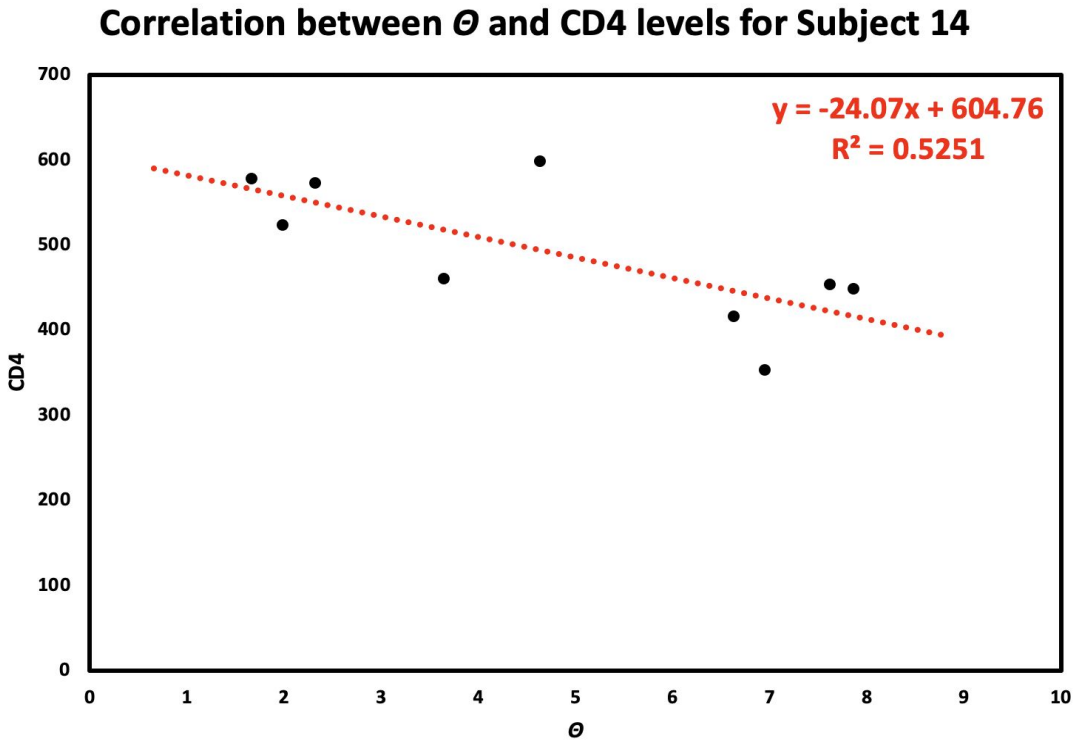
# Subject 14's data showed the strongest correlation between Θ and CD4 T-cell levels...

**P-value = 0.027**

P<0.05, so we reject the null and accept the alternate.
There is significant statistical evidence to say that there is an inverse relationship.



# ...but it is best represented visually when scaled down.



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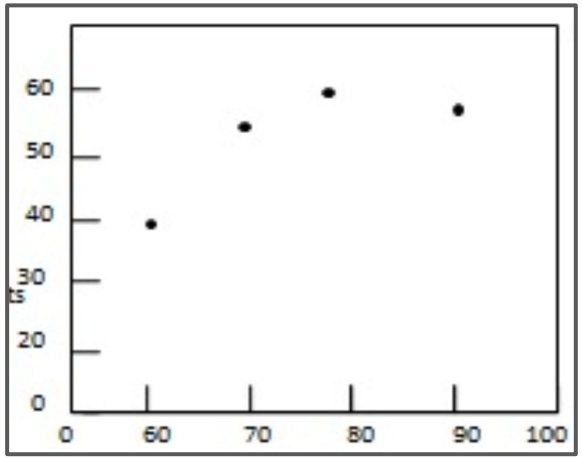
# Non-progressors do not necessarily need to show a decrease in CD4 T-cell levels.

- The graphs for non-progressors and moderate progressors revealed slight positive slopes for the best fit line between variables.
  - Need virus replication for genetic diversity and divergence (Gaardbo *et. al.*, 2012)
- Our data supports the model proposed by both Markham *et. al.* (1998) and Nowak *et. al.* (1991) for the relationship between Θ and T-cell depletion in all subjects.
  - ↑ divergence → ↓ CD4 T-cell levels
- While statistically insignificant, data for all progressor groups followed predicted trends.

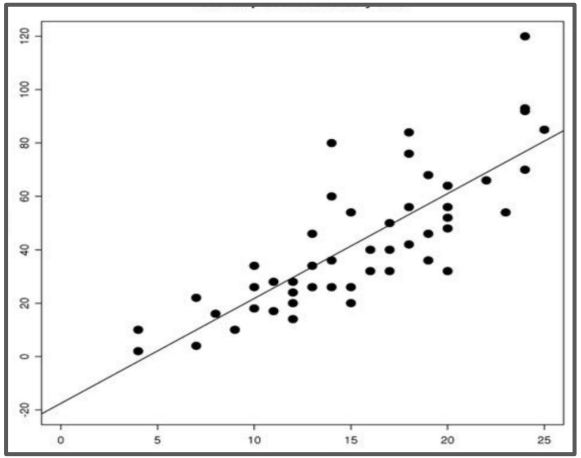
Gaardbo *et. al.*, (2012);
Markham *et. al.*, (1998);
Nowak *et. al.*, (1991)

# What can be improved?

- Repeat experiment, but make sure to sequence DNA at every visit
  - More data points, more correlation if there is one




**VS.**




- Now that we know there is a correlation, we can develop a drug that can be used to target a wider range of genetic divergence → more effective treatment plans

# Acknowledgments


- We would like to thank...
    - Professor Dr. Dahlquist,
    - TA Alice Finton,
    - our fellow BIOL 368 classmates,
    - Markham *et. al.* (1998),
    - and the Loyola Marymount University Biology department!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# Thank you for listening!

# Questions? Comments?