

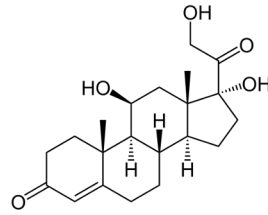
# Correlating Cortisol and Academic Performance

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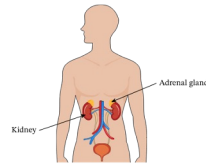
## Abstract:

Stress has far-reaching consequences, not just for individuals but society generally. 5-8% of total healthcare costs and 120,000+ deaths are attributed to stressful workplaces and burnout per year (Goh 2016). At the individual level, burnout and stress inundation can cause anxiety disorders, heart disease, and immunosuppression. How do we prevent/mitigate these problems?

This study seeks to further articulate the bridge between the mind and the body, how psychological stress creates and is also affected by biological stress. In uncovering more of the details behind this link, this study also seeks to understand at what point of psychological or biological stress might there be enough warning signs of burnout to warrant immediate action. The relationship between cortisol, a stress hormone released in response to stressful stimuli, and answers to questionnaires about stress will be explored. In addition, these results will then be helpful in exploring the significance of students' academic performances at the end of a semester.



cortisol (above), a steroid hormone produced by the adrenal glands atop the kidneys (below). Chronic exposure is correlated with failing physical health.



At left, the chain reaction that occurs, involving the brain's hypothalamic-pituitary-adrenal axis, and the adrenal gland which produces cortisol.

## Methodologies

### Sample Collection:

Ten students will answer stress questionnaires asking about their experiences in the past month. Students will then swab for saliva according to instruction for SOS (SalivOralSwab) kit.

Students will then attend 30 minute meditation in peaceful ambient room (The Well) to mitigate confounding acute stressors and ground everyone at a similarly relaxed state.

Students will swab one more time after meditation and before departing.

Students will repeat this process 6 times total, 5 during the semester (3 weeks in-between sessions) and one last session after the end of finals.



Meditation will be used as a method of equilibrating people's stress levels, to mitigate acute stressors.

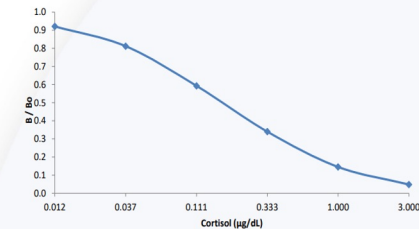
## Methodologies

### Sample Analysis: Salivary Cortisol ELISA

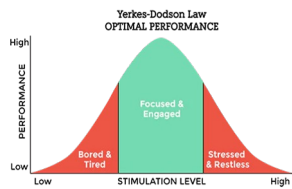
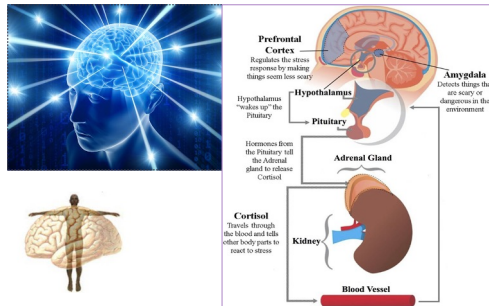
Competitive binding assay, horseradish peroxidase will bind to cortisol in plate if there is no sample cortisol to do so and will create noticeable change in solutions.

If there IS sample cortisol to bind to antibody binding sites on plate, horseradish peroxidase will not bind, won't cause a change in the plate color and will be washed away. Standard plate reader at 450 nm used to observe changes. Horseradish peroxidase reaction is blue. The amount of color change that occurs in a sample can then be compared to a set of standards, which we know the concentrations of cortisol for. Interpolating how much color change has occurred compared to known cortisol standard's color change will help us understand the concentration of cortisol in a sample.

Example: HS Cortisol 4-Parameter Curve Fit



Above, an example of a standard curve, provided in the manual for the Salimetrics ELISA kit



At left: Visualisation of Yerkes-Dodson Law, the idea that some stress is good, too little or too much is not

## The Research Questions

What level of stress is healthiest for productivity?

Is there an amount of stress that is insurmountable with regards to productivity and positive growth?

Do people who do not succeed to the same extent as their peers exhibit more stress, or do people who do well academically have more stress due to those ambitions?

Do moments of high acute stress have more influence on final performance or does duration of chronic stress over a time period influence results most?

Can college students serve as reliable and efficient models of human stress?

Future research question: To what extent are people with high stress able to recover quickly from stress?

## Results

To be determined! But there is value in hypothesizing what results may look like and how to interpret them. Correlations will be created between questionnaire and cortisol levels, and also between these, to academic performances to see if one explains academic performance better. I am also interested to see how much cortisol increases on average, based on number of credits taken.

t-tests will occur between groups based on how much cortisol was present, to see if there was a difference in grades based on how much stress regularly appeared.

The highest interval average of 3 sessions for each person will also be compared to their final academic performance (Grade Point Average \* (#LD Credits\*2 + #UD Credits\*4). The average of those 3 intervals will represent a chronic stress component, which will also be correlated to final results, to see if this explain results in a way that makes more sense.

## Conclusions:

No conclusions have been made as of now, though there are many aims for this project.

This project aims to quantify stress in such a way that may be useful for gauging a person's mental and physical health before and during the an academic semester. Using the college student model, this project aims to create a general workforce model, where cortisol measurement can be used to approximate probability of burnout or decreased ability to perform, generally.

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