The Stress Response

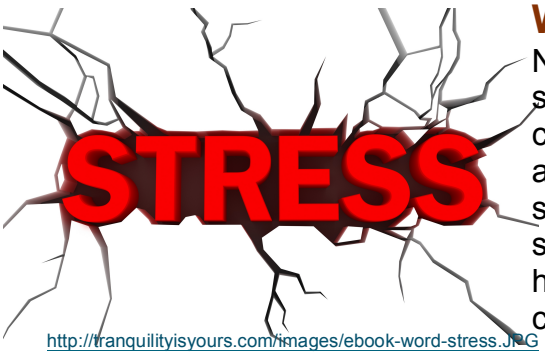
HASPI Medical Anatomy & Physiology 12b

Lab Activity

Name(s): _____

Period: _____ **Date:** _____

Background



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What Causes Stress on the Body?

Not all stress is negative. The body has a mechanism to deal with stress in place to assist the body in escaping a physical confrontation or threat. "Good" stress is normally associated with an acute, or immediate, threat or condition. Chronic, or long-term stress, is not good for the body and can result in physical symptoms and damage to the body. Stress causes an upset in homeostasis when the body responds to a threat. A body that is continuously out of homeostasis or balance is not healthy.

Stress can be caused by many different types of stressors, or stress-causing agents. Stressors can be psychological or mental, physical, environmental, or related to life events or lifestyle. Some of these stressors can be controlled and/or managed while others are outside of our control.

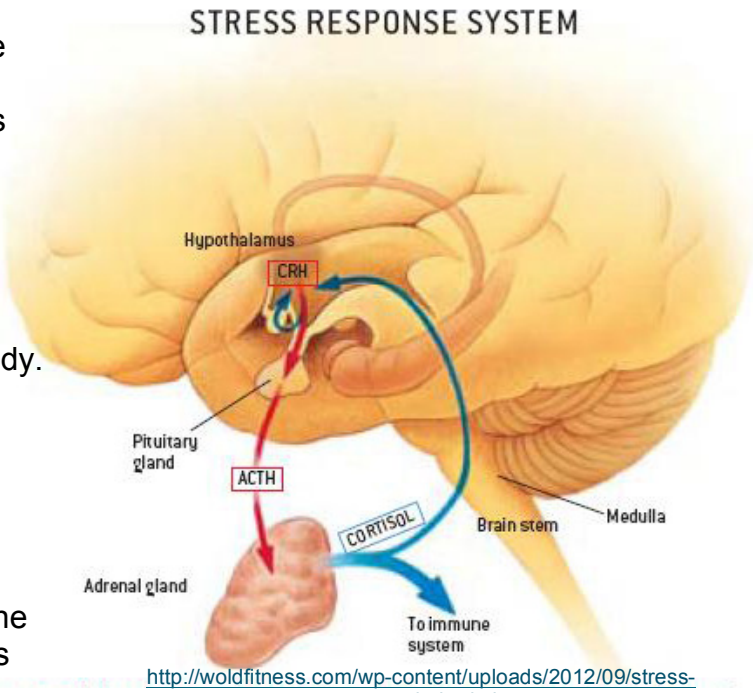
- **Psychological or mental stressors** may include depression, anxiety, emotional trauma, and any other factors that may negatively impact mental health.
- **Physical stressors** may include injuries, illness, infection, pain, surgery, overexertion, or strain on the body.
- **Environmental stressors** may include temperature extremes, poor sanitation, pollution, lighting, noise, and extreme weather conditions.
- **Life event stressors** may include birth, death, weddings, purchases (house, car, etc.), relocation, and any other major life event.
- **Lifestyle stressors** may include work, daily hassles, poor time management, overspending, sleep deprivation, poor nutrition habits, and drug/alcohol use or abuse.

The Physiological Response to Stress

Stress results in the body stimulating a response through the endocrine, nervous, and/or immune systems. The stimulation of these body systems causes physical changes that can have acute and chronic effects on the body.

Acute stress causes a flood of cortisols (noradrenaline and adrenaline) to be released from the adrenal glands, preparing the body to deal with the perceived stress or threat to the body. The pathway by which the body releases these hormones is actually quite complex.

Once the body perceives a stressor, the brain releases a neurotransmitter that stimulates the hypothalamic-pituitary-adrenal axis (HPA). The hypothalamus acts as the connection between the nervous system and the endocrine system in this pathway. The neurotransmitter stimulates the



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hypothalamus, which then releases corticotropin-releasing hormone (CRH) through a vein that leads directly to the anterior pituitary gland. CRH stimulates the anterior pituitary gland to produce and release adrenocorticotropic hormone (ACTH) that is released into the blood stream and finds its way to the adrenal glands. ACTH stimulates the adrenal glands to produce adrenaline and other cortisols. These hormones allow the body to access energy stores within the body quickly.

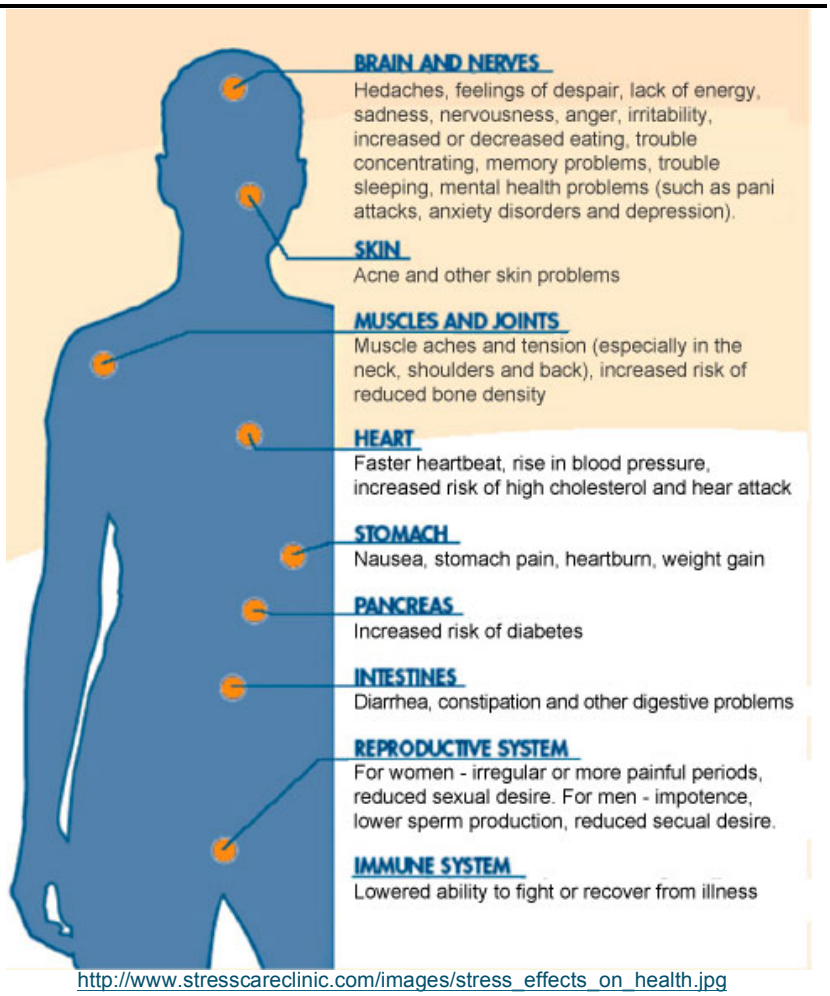
The hypothalamus is also capable of quickly stimulating the adrenal glands to release adrenaline when needed quickly in the "fight or flight" response. As the stressor decreases, the body will signal the adrenal glands to discontinue producing these hormones and the levels will return to normal. A body that is exposed to a long-term will continue to produce these hormones, which may lead to symptoms of chronic stress.

Acute Physiological Effects of Stress

- Increased heart rate and blood pressure
- Slowed digestion to divert energy to muscle contraction
- Slowed saliva and mucus production
- Dilated pupils for increased vision sensitivity
- Endorphin release to reduce the feeling of pain if inflicted
- Acute sensory sensation
- Increased platelet production and blood clotting if injury occurs
- Release of glucose and fat into the bloodstream for energy
- Dilation of the bronchi to allow increased respiration rate
- Shallow, quickened breathing to allow increased oxygen to muscles

Chronic Physiological Effects of Stress

- Anxiety
- Panic attacks
- Depression
- Fatigue
- Crying fits
- Mood swings
- Digestive issues
- Muscle tension
- Soreness
- Frequent illness
- Frequent headaches/neck aches
- Skin conditions
- Respiratory distress
- High blood pressure
- Heart disease and/or stroke



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Materials

Ice water	Paper towel	Clothespin
Stethoscope	Sphygmomanometer	
Timer	Radio or iPod with headphones	

Procedure

The following activities will let us observe the acute effects on heart rate and blood pressure that are caused by a few simple stressors. Your instructor may have you investigate only a few stressors or all of the stressors.

PART A: Physical Stress: Exercise

		✔when complete
Step 1	Hypothesize what effect exercise stress will have on the heart rate and blood pressure of the test subject in the "Hypothesis" section for Exercise Stress in Table 1.	
Step 2	Have the test subject sit quietly, eyes closed, and with no talking for 3 minutes.	
Step 3	Use the stethoscope and sphygmomanometer to record the resting heart rate and blood pressure in the "Pre-Stress" column for Exercise Stress in Table 1. Do not remove the sphygmomanometer.	
Step 4	Have the test subject run in place. While the test subject is running, record the heart rate and blood pressure at 1-minute intervals for 3 minutes. The test subject will need to hold the arm with the sphygmomanometer still while heart rate and blood pressure are being taken.	
Step 5	Record Exercise Stress in Table 1 (Trial 1 = 1 minute, Trial 2 = 2 minute, and Trial 3 = 3 minute).	
Step 6	At the end of 3 minutes, have the test subject sit quietly, eyes closed, and with no talking for 3 minutes.	
Step 7	Record the heart rate and blood pressure of the test subject in the "Post-Stress" column for Exercise Stress in Table 1.	

PART B: Environmental Stress: Temperature

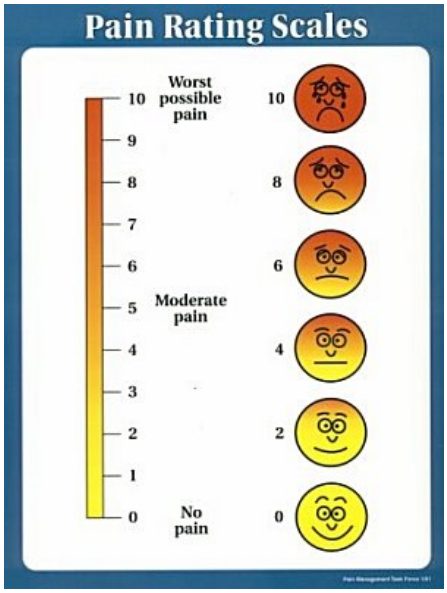
		✔when complete
Step 1	Hypothesize what effect temperature stress will have on the heart rate and blood pressure of the test subject in the "Hypothesis" section for Temperature Stress in Table 1.	
Step 2	Have the test subject sit quietly, eyes closed, and with no talking for 3 minutes.	
Step 3	Use the stethoscope and sphygmomanometer to record the resting heart rate and blood pressure in the "Pre-Stress" column for Temperature Stress in Table 1. Do not remove the sphygmomanometer.	
Step 4	Have the test subject place and keep one hand in the tub of ice water.	
Step 5	Record the heart rate and blood pressure at 1-minute intervals for 3 minutes. Record Temperature Stress in Table 1 (Trial 1 = 1 minute, Trial 2 = 2 minute, and Trial 3 = 3 minute).	
Step 6	Have the test subject remove the hand from the ice water and sit quietly, eyes closed, and with no talking for 3 minutes.	
Step 7	Record the heart rate and blood pressure after 3 minutes in the "Post-Stress" column for Temperature Stress in Table 1.	

PART C: Physical Stress: Orthostatic Hypotension

		✔when complete
Step 1	Hypothesize what effect orthostatic stress will have on the heart rate and blood pressure of the test subject in the "Hypothesis" section for Orthostatic Stress in Table 1.	
Step 2	Have the test subject lie down quietly, eyes closed, and with no talking for 3 minutes.	
Step 3	Use the stethoscope and sphygmomanometer to record the resting heart rate and blood pressure in the "Pre-Stress" column for Orthostatic Stress in Table 1. Do not remove the sphygmomanometer.	
Step 4	After 3 minutes, have the test subject stand upright leaning on a wall and continuing to relax as much as possible. Record the heart rate and blood pressure **immediately** upon standing, then at 2 minutes and 4 minutes. Record Orthostatic Stress in Table 1 (Trial 1 = immediately upon standing, Trial 2 = 2 minutes, Trial 3 = 4 minutes).	
Step 5	Have the test subject sit quietly, eyes closed, and with no talking for 3 minutes.	
Step 6	Record the heart rate and blood pressure in the "Post-Stress" column for Orthostatic Stress in Table 1.	

PART D: Physical Stress: Pain

		✔when complete
Step 1	Hypothesize what effect pain stress will have on the heart rate and blood pressure of the test subject in the "Hypothesis" section for Pain Stress in Table 1.	
Step 2	Have the test subject sit quietly, eyes closed, and with no talking for 3 minutes.	
Step 3	Use the stethoscope and sphygmanometer to record the resting heart rate and blood pressure in the "Pre-Stress" column for Pain Stress in Table 1. Do not remove the sphymanometer.	
Step 4	Have the test subject place the clothespin on the tip of the pinky finger. The test subject should feel discomfort, but not extreme pain, such as the 2-4 range according to the "Pain Rating Scale" to the right.	
Step 5	If it is too painful, have the test subject squeeze the clothespin to relieve the pain slightly, and if it is not uncomfortable have the test subject squeeze the clothespin on the finger harder.	
Step 6	Record the heart rate and blood pressure at 1 minutes, 2 minutes, and 3 minutes. Record Pain Stress in Table 1 (Trial 1 = 1 minute, Trial 2 = 2 minute, and Trial 3 = 3 minute).	
Step 7	Remove the clothespin and allow the test subject to rest for 3 minutes. Record the heart rate and blood pressure after 3 minutes in the "Post-Stress" column for Pain Stress in Table 1.	



http://www.southwestspineandpain.com/wp-content/uploads/2011/09/st_george_painscale.jpg

PART E: Environmental & Mental Stress: Noise & Test Taking

		✔when complete
Step 1	Hypothesize what effect noise stress will have on heart rate and blood pressure of the test subject in the "Hypothesis" section for Noise Stress in Table 1.	
Step 2	Have the test subject complete as many of the following "Pre-Stress" math problems as possible over a **2-minute period** (no calculators!). Scratch paper may be used.	
Step 3	Use the stethoscope and sphygmomanometer to record resting heart rate and blood pressure in the "Pre-Stress" column for Noise Stress in Table 1.	
Step 4	Have the test subject put on the headphones and turn on the radio or iPod. The music should be loud enough to drown out all outside noise, but not loud enough to cause discomfort. The music genre should be **annoying and/or obnoxious** to the test subject.	
Step 5	The test subject will complete as many of the "Trial Period" math problems as possible over a 2-minute period (no calculators!). Scratch paper may be used.	
Step 6	At the end of 2 minutes, record the heart rate and blood pressure of the test subject and record in the Trial area for Noise Stress in Table 1.	
Step 7	Remove the headphones from the test subject and turn off the radio or iPod.	
Step 8	Have the test subject complete as many of the "Post-Stress" math problems as possible over a 2-minute period (still no calculators!). Scratch paper may be used.	
Step 9	At the end of 2 minutes, record the heart rate and blood pressure of the test subject in the "Post-Stress" column for Noise Stress in Table 1.	

Pre-Stress Math Problems			Trial Period Math Problems			Post-Stress Math Problems		
56 x 89	124 x 44	395 x 782	22 x 91	783 x 43	593 x 287	76 x 34	643 x 98	708 x 321
2358 x 334	678 x 144	777 x 985	8547 x 102	671 x 980	652 x 145	1097 x 483	467 x 333	198 x 163
3495 x 482	7853 x 1144	12456 x 386	1644 x 834	9124 x 1155	28379 x 845	3578 x 821	7593 x 6673	22976 x 104
57864 x 589	423768 x 5444	687395 x 17082	72854 x 224	194678 x 6833	385293 x 14672	93645 x 746	578291 x 1423	846782 x 38912
76 ÷ 2	333 ÷11	770 ÷22	112 ÷ 2	225 ÷ 5	552 ÷16	115 ÷ 2	504 ÷ 9	3465 ÷45
1100 ÷55	574 ÷7	2047 ÷ 89	3075 ÷ 41	1207 ÷14	1615 ÷ 19	9776 ÷13	478 ÷4	8965 ÷ 74
414 ÷92	5616 ÷156	68884 ÷112	1927 ÷21	9864 ÷152	92356 ÷72	567 ÷53	9237 ÷643	23647 ÷321

Analysis

Complete the following table with data from the lab activities.

Table 1: Heart Rate and Blood Pressure Under Stress

Stress Test		Hypothesis	Pre-Stress	Trial 1	Trial 2	Trial 3	Post-Stress	Actual Response
Physical: Exercise Stress	HR							
	BP							
Environmental: Temperature Stress	HR							
	BP							
Physical: Orthostatic Stress	HR							
	BP							
Physical: Pain Stress	HR							
	BP							
Environmental: Noise Stress	HR							
	BP							

Analysis Questions - *on a separate sheet of paper complete the following*

1. Why was it important to take the test subject's heart rate and blood pressure while sitting quietly with eyes closed?
2. Why was the "post-stress" heart rate and blood pressure taken?
3. What was the impact of exercise stress on blood pressure and heart rate?
4. How do you think the results would have changed if the exercise was more strenuous, for example running a mile in under 6 minutes?
5. What was the impact of temperature stress on blood pressure and heart rate?
6. What was the impact of orthostatic stress on blood pressure and heart rate? Hypothesize as to why you think this happened.
7. What was the impact of pain stress on blood pressure and heart rate?
8. What was the impact of noise and test taking stress on blood pressure and heart rate?
9. How can you be certain that the results were from noise AND test taking rather than just one or the other?
10. How could you restructure the experiment in Part E to see if noise OR test taking caused stress?
11. Explain what was occurring in the body to increase the heart rate and blood pressure of the test subject during the stress tests.
12. What outside factors may have affected the results?