Instructions and Expectations

Read the following article and answer questions provided. Make sure you scroll all the way to the bottom to ensure you have read and completed all of this assignment. Responses are due on the day of returning back to school in person.

What happens on an eLearning Day?

On eLearning Days, students will not report physically to school but will instead work from home. Students will have regular assigned classwork and their teachers will be available electronically during office hours. Students will be required to complete and submit all assignments as well as communicate with their teachers during the emergency eLearning Day.

How will students and parents know if an eLearning Day will take place?

Hampton County School District (HCSD) will communicate school cancellations and the announcement of an eLearning Day through automated phone calls, the district's notification system, district/school websites, social media, and local media.

How will students be informed about assignments for an eLearning Day?

Teachers will deliver content and post their assignments in Microsoft TEAMS. Students will download their assignments to their devices ahead of time at school as part of teachers' emergency plans.

How will students get help on their assignments on an eLearning Day?

All teachers will be available during designated eLearning office hours to provide assistance to students, give feedback on assignments, collaborate, and answer questions.

When will assignments be due?

As students complete their work, they should upload their assignments if Wi-Fi is available. If an internet connection is not available, they will have up to three school days after the last school cancellation to turn in assigned work.

How will eLearning be monitored and counted for attendance?

Teachers will assess the student's work and determine if the student has met the instructional goals for the day.

Students will be counted present when they:

Complete and submit their digital assignments for the eLearning Day following the eLearning procedures

It's Just Stress, Right?
A Case Study on the Endocrine System



by
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Part I – Frustration

Ellie dropped her backpack beside the chair in Dr. Kern's office and sat down with a sigh. Her hands trembled as she glanced again at the graded exam in her hand.

"It's no better than the last one," she mumbled. "I really, really tried this time, Dr. Kern. I did all the reading assignments before and again after class. I completed all of the study guide questions and rewrote my notes and made flash cards and studied with straight-A Cassie every week. But it didn't make any difference. I still failed it." She sniffled loudly and reached for the box of tissues on Dr. Kern's desk.

Dr. Kern sat back and thought for a moment while Ellie made use of several tissues. Ellie was a junior in Dr. Kern's physiology course and had struggled from the start of the semester. One-on-one help sessions and different study strategies hadn't seemed to help. "I know how discouraged you must be, Ellie. Tell me again what you do when you sit down to study."

"I read and review my class notes and reread the assigned sections in the book. But for some reason I can't concentrate on much of anything for very long and, even when I can, I don't remember what I've studied by the next day. It's so frustrating to spend so much time studying and not retain anything. If I fail this class, my GPA might drop enough that I'll lose my scholarships. I'm so stressed that I can't sleep, even when I try."

Ellie broke off, and Dr. Kern gently tried to encourage her. "Let's not give up hope yet. Sometimes you have to use new study methods for a while until you start to see some benefits. Let's also take a look at your exam and see if there's a pattern in the questions you missed."

Ellie sniffled again. "OK, but I'm not very hopeful. I've been thinking about changing my major. All these upper-level courses seem so hard … there's so much to learn in such a short time and I just don't seem to get it even though everyone else does. I can't stand the stress anymore."

"Perhaps talking this over with your parents or a trusted friend would help," Dr. Kern suggested. She noted Ellie's strikingly large blue eyes that gave her a permanent look of surprise. Ellie was also quite thin, almost to the point of being too thin. Dr. Kern paused and chose her words with care. "I also know there are terrific folks over at the health center who are experts in how to deal with stress."

Ellie gave a small, noncommittal smile and pushed a shaking hand through her hair. "Thanks, I'll think about it. See you in class on Monday."

However, Ellie didn't come to class on Monday or Wednesday. She emailed Dr. Kern that she most likely had a sinus infection and would miss class on Friday to see a doctor. Dr. Kern shook her head at Ellie's misfortune; missing a week of class was not going to make it any easier for Ellie to pull up her grade.

Questions

1. Note anything unusual about Ellie's behavior or appearance.
2. What do you think might be going on with Ellie that could cause her difficulties? Consider both physical and psychological causes.

Part II – Health Center

Ellie sat in a small exam room of the student health center, feverish and with a throbbing headache. A sinus infection right before midterms was not what she needed.

Dr. Simmons entered in a rush and took a quick look at her chart. "Hmm … fever, headache, green nasal discharge that you've had for two weeks. Sounds like your sinuses have been invaded by something nasty. Does this hurt?" He pressed his thumbs on Ellie's cheeks, which nearly sent her through the ceiling. "Yep. Let's try some antibiotics to clear that up."

He reached for his prescription pad, but stopped and glanced at Ellie's face again. "Your eyes protrude a bit. Have they always been that way?" He turned her face to look at her profile and frowned slightly.

Ellie had no idea what her eyes had to do with her sinus infection. "I haven't noticed. But I've been so stressed lately that I don't notice a lot of things." She paused and then continued, "My little brother did start calling me 'Bug Eyes' this summer, but he's just an annoying 10-year-old."

Dr. Simmons nodded and then gently palpated her neck. He looked at her chart again. "Your blood pressure and pulse are elevated. Your fever might account for that, but there could be something else going on here." Ellie felt a small knot form in her stomach. This was supposed to be a simple sinus infection, nothing more.

Dr. Simmons began to fire questions at her. Did she have trouble sleeping? Did she often feel nervous or "jittery"? Had she lost weight recently? Did she often feel like the room was too warm? Did she have frequent bowel movements or diarrhea?

Ellie's head spun. "Uh, y-yeah, but I'm just stressed, you know, with classes. Aren't all those things just signs of stress?"

"They certainly can result from stress, and I see a lot of students where that is the case. However, there is a slight swelling in the front of your neck. That combined with your other symptoms suggests that perhaps your thyroid gland isn't functioning quite the way it should. I'd like to take a look before we assume your symptoms are all due to stress. Let's start with some simple blood tests and see what we find."

He scribbled a lab order and smiled kindly. Ellie grabbed the papers and left, feeling worse than when she first came in.

Questions

1. Where is the thyroid gland located?
2. List the hormones secreted by the thyroid and describe their general actions.
3. Protrusion of the eyes is called exophthalmos. How is it related to thyroid dysfunction? What causes it?
4. What is the significance of the slight swelling in Ellie's neck?
5. Based on the information you have at this point, do you think Ellie's thyroid gland is hyperactive or hypoactive? Explain your answer.
6. Dr. Simmons ordered blood tests to measure Ellie's levels of thyroid hormone and thyroid-stimulating hormone (TSH or thyrotropin). If Ellie has a hyperactive thyroid, what are the expected results? What are the anticipated results if she has a hypoactive thyroid?

Part III – Thyroid Trouble

Once again, Ellie sat in the exam room waiting on Dr. Simmons. He flew in the door, grabbed a stool and, to Ellie's relief, got right to the point. "Well, your blood work does show some problems with your thyroid. Your TSH levels are lower than they should be, your T_4 levels are a bit high and your T_3 levels are very high. Those results suggest that you might have Graves' disease, which means that your thyroid is releasing too much thyroid hormone. Since thyroid hormones are responsible for your metabolic rate, that explains why your heart rate and blood pressure are elevated, why you've felt nervous and can't sleep, and why you've lost weight even though you aren't dieting."

Ellie's mind whirled. "Sooooo, could this also be why I can't concentrate when I try to study and why I can't seem to remember anything?" Maybe there was still some hope for her in Dr. Kern's physiology class.

"Well, maybe," Dr. Simmons answered. "Some studies suggest that excess thyroid hormone is correlated with decreased attention, concentration, and working memory. In other words, your thinking might not be as clear as it should be. However, other experts argue that it's the anxiety and nervousness that cause patients to feel their thinking is impaired, even though there is no actual impairment. The good news is that with treatment patients report an improvement in their cognitive abilities, regardless of the underlying cause."

Ellie felt a twinge of relief. "Oh, good! That will certainly help my grades. But why is my thyroid releasing too much hormone? And you said my TSH levels were low. Isn't TSH a thyroid hormone? If my thyroid is too active, shouldn't it be high instead of low?"

Ellie has just asked some very good questions. If you were Dr. Simmons, how would you answer her?

Questions

1. What is causing Ellie's thyroid to secrete too much hormone?
2. Is Ellie correct in thinking that TSH is a thyroid hormone? Why is her TSH level low instead of high?

Part IV – Options

Dr. Simmons continued. "I'm going to refer you to a local endocrinologist, someone who specializes in disorders like this. She will probably order a radioactive iodine uptake test and a thyroid scan to confirm that you have Graves' disease and determine the best way to treat it."

At Ellie's look of alarm, he explained. "Don't worry … the amount of radioactivity is very small and not harmful, so you won't start to glow. The thyroid gland incorporates iodine into its hormones, and if we tag the iodine with radioactivity, we can measure the amount of iodine taken up by the thyroid."

Ellie jumped in. "And if my thyroid is overactive, it will use more iodine than it should, right?"

"Exactly," responded the doctor. "Assuming that your uptake is elevated, there are several ways to treat your condition. Unfortunately, we can't cure it. However, there are some medications that can help, and another procedure that involves radioactive iodine. Surgery to remove the thyroid is also an option, although not a common one anymore. The endocrinologist will evaluate your test results and help you choose the best treatment. Until then, I'm going to prescribe a beta-blocker that should help lower your heart rate and reduce that nervous feeling you've had."

Several weeks later, Ellie dropped her backpack beside the chair in Dr. Kern's office and sat down with her latest physiology exam and a smile. "I think there's hope!"

"I agree. Tell me about this dramatic turn-around," Dr. Kern smiled in return. Ellie was still very thin and her blue eyes startlingly wide. However, the fidgeting and shakiness were gone and the overall impression was one of calmness and purpose.

Ellie explained how a sinus infection led to discovery of her thyroid disorder. "I'm taking some medication now until the radioactive iodine treatment becomes effective, and I feel so much better. I can sleep, I can concentrate, and I think I can pull up my grade enough to pass the course!"

Dr. Kern smiled again. "So often signs of stress are just that, but occasionally there is another explanation. I'm so glad you found out what was going on sooner rather than later, and I'm sure this will reduce your stress levels even further. We'll look for even better results on the next exam."

Ellie laughed. "Oh, it covers the thyroid gland. I think I can ace that part!"

Questions

1. Ellie is a 20-year-old female. Do some research on the average age of onset and any gender differences in Graves' disease to see if Ellie's diagnosis is unusual.
2. How are beta-blockers like propranolol helpful as an initial treatment for Graves' disease? Do they have any effect in reducing thyroid hormone levels or do they counter the effects of the hormones?
3. After Ellie's diagnosis of Graves' disease was confirmed by the uptake test, her endocrinologist explained several options for long-term treatment, which are listed below. For each treatment, describe the major advantages and disadvantages.

a. Anti-thyroid medications (methimazole, propylthiouracil)—these medications slow the production of thyroid hormones.

b. Radioactive iodine—a stronger dose of radioactive iodine is given to gradually destroy the thyroid gland.

c. Surgery—part or all of the thyroid gland is removed.

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Not An Old Person's Disease

Part I—"Soaking Up the Sun"

by
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Judy sat up, took a swig from her water bottle, and wiped the sweat off of her face. She glanced at her watch and frowned. Had they only been out here for half an hour? Man, trying to get a good tan was way too much work. She glanced over at Mariah who was sleeping peacefully in her lounge chair. No wonder she looked like a Greek goddess every summer—she *enjoyed* lying in the sun. Judy decided that her normally pasty-white skin was tan enough, getting a little red again in fact, and she started to gather her things. Anyway, she reasoned, a dark tan might clash with her red hair.

Judy stopped for a second to scratch her calf. It had been itching for several days now, and she figured that the mosquitoes had really gotten her at the barbecue the other night. Since she was on the ground, she bent her neck to look at it and was surprised to see that it wasn't a mosquito bite but a mole. She'd had this mole ever since she could remember, but it had never itched before. She looked a little more closely and noticed that the mole looked kind of different than she remembered. It was a little bigger and the edges were sort of jagged. One edge was a bit darker than the other and in the middle was a raised purplish-black dot that she tried to wipe away but couldn't. As she was staring at her leg, Mariah woke up.

"What are you day dreaming about, your hot date with Tim tomorrow night?" Mariah teased as she rolled on her side, her black hair falling into her eyes.

Judy shook her head, "Ha, ha, I do have more things in my life to ponder. Anyway, I just noticed that a mole on my leg looks kind of weird and it keeps itching."

Mariah sat up with a concerned look on her face. "Let me see it." As she looked at Judy's leg, she said quietly, "Maybe you should go to the clinic." As Judy stared at her, she continued. "My mom sent me a pamphlet on skin cancer last year. You know, trying to convince me to stop lying in the sun so much. I glanced through it before I tossed it into the garbage. I remember some of the pictures of skin cancer and they kind of looked like your mole."

"What are you talking about?" Judy said defensively. "How could I have skin cancer? I'm barely in the sun compared to you."

"Alright, alright. It's not like I'm a doctor or something. I just remember those pictures. Come on, let's just call the clinic so they can check you out. I'm sure they'll tell you I'm crazy."

Questions:

1. What are some differences between Judy and Mariah that might make Judy more "at risk" for skin cancer than Mariah?
2. What observations did Judy make concerning her mole?

*__Note:__ Both authors contributed equally to this case and its teaching notes.

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Not An Old Person's Disease

Part II—"The Basics of Cancer"

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Judy did a little research about skin cancer on the Internet before her doctor's appointment the next morning. She learned that most cases occurred in people who were significantly older than she was. It didn't make sense that it would happen to her—she was only 20 years old!

The articles talked about how UV light from the sun causes mutations in your DNA. Accumulation of DNA mutations over many years can cause certain cell cycle genes called "proto-oncogenes" to become super-active. Judy actually felt thankful for the college biology course she had been forced to take. She knew that DNA was the hereditary material that acted as a "blueprint" for everything our cells make and that a gene is a piece of DNA that contains the instructions for making a single protein. However, she would have to ask the doctor about these proto-oncogenes.

In the examining room, Dr. O'Brien was silent as he looked at the mole on her leg. Finally, he said kindly, "I want to do a biopsy. All that means is we'll remove your mole and look at the cells under a microscope and see if they look abnormal."

Judy could feel the tears welling up in her eyes. "You mean you can tell if I have a tumor by just looking at some cells?"

"Whoa, slow down a minute," Dr. O'Brien replied calmly. "It's very possible that your cells will look completely normal. And to clarify something, a tumor is not necessarily the same thing as cancer." She looked confused, so he continued. "A tumor means that cells have divided and piled up on one another in a single mass. But not all tumors are automatically cancerous and life threatening. A benign tumor is a mass of normal-looking cells. These tumors are not considered cancer and they're usually relatively easy to treat—we just remove them. On the other hand, a malignant tumor is a mass of abnormal cells whose growth cannot be controlled by the regular mechanisms. In addition, malignant tumors often spread to other parts of the body instead of just staying in one spot. We call this process metastasis. Malignant tumors are cancerous and, therefore, a very serious condition. To treat them, we have to remove the cancerous cells that we find and then do chemotherapy treatments to be sure to kill all the cancer cells that we may have missed surgically."

"So, if I have cancer, is it from these proto-oncogenes that I read about on the Internet?"

The doctor smiled and seemed pleased that Judy had been reading about this on her own. "Let's back up for a minute. You see, we have tens of thousands of genes in our cells, but it's not like mutations in just any of them will lead to cancer. The genes that get mutated and can cause cancer are of a specific type called cell cycle genes. *Everyone* has a set of cell cycle genes in each of their cells that code for cell cycle proteins. Cell cycle proteins control if and when cells divide. Sometimes we need to make more cells in our bodies, and some of these cell cycle proteins allow that normal process of cell division to occur. At other times we don't want the cells to divide, so different cell cycle proteins inhibit cell

division then. In normal, healthy cells, the formation of the cell cycle proteins is tightly controlled so the activating proteins are only made when we really need more cells and the inhibitory proteins are only made when we don't need more cells. However, mutations (or alterations) in these genes can eliminate this tight regulation and lead to uncontrolled cell division. This is what happens in many types of cancer: a normal cellular process, cell division, is no longer properly controlled."

Judy thought for a second. "Okay, but you still didn't say what these proto-oncogenes are."

"Oh yes, sorry. The activating class of these cell cycle genes consists of the proto-oncogenes. The normal job of these genes is to code for proteins that promote cell division. Certain mutations in proto-oncogenes result in proteins that are active all the time, causing cells to divide continuously. But let's not get ahead of ourselves—we won't know if your mole is even cancerous until we do the biopsy."

When Judy didn't say anything in response right away, Dr. O'Brien continued, "I know this is all a bit confusing, but it's good that you're asking these questions. We'll make sure that you understand this a little better before you leave today."

Just then a nurse knocked and entered the room. He needed Dr. O'Brien for a minute. At least Judy would have a minute to gather her thoughts.

Questions

1. Considering the differences between a benign tumor and a malignant tumor, why might a benign tumor be easier to treat?
2. Judy learned that every single person has these cell cycle genes so cells in our body can divide when necessary. What are some normal circumstances where our bodies might need to make more cells?
3. Every person has these cell cycle proto-oncogenes, but not every person has cancer. Why might this be the case?

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Not An Old Person's Disease

Part III—"Like Mother, Like Daughter?"

by
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Dr. O'Brien had handed Judy a pamphlet on melanoma before he left the room. As she started reading it, Judy realized that this is what they were going to test her for. Melanoma is a type of skin cancer that starts in your melanocyte cells, or the pigment cells of your skin. Actually, a mole is just a clump of melanocytes. There were pictures of cancerous moles in the pamphlet and one of them looked a little like hers, only bigger. She was starting to get worried. Below is part of what she saw:

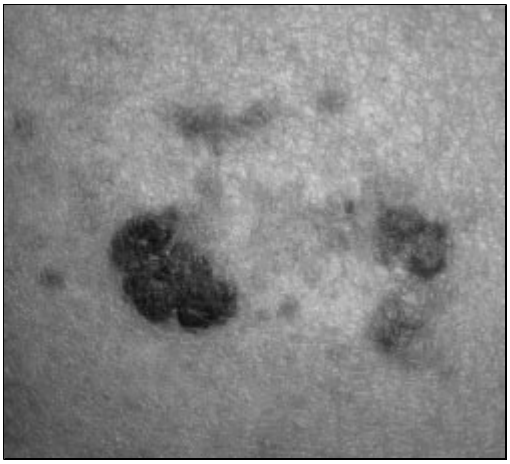


Image courtesy of Arthur C Huntley MD,
University of California Davis
http://www.mpip.org/guide/suspindex.html.

Dr. O'Brien returned just then and apologized for the disruption. "Do you have any more questions?"

"Well, I just don't understand how it's possible for a 20-year-old to get cancer. Isn't cancer an old person's disease?"

"You're right that most cancer patients are older. That's because you accumulate mutations in your genes over time. UV light, cigarette smoke, other chemicals, and even aging itself can cause mutations in genes. The kind of cancer that we're checking your mole for is melanoma. This is the most common cancer in people aged 25 to 29 and is the fastest-growing category of cancer, increasing four percent each year. You are a bit young, but you may be genetically predisposed to melanoma."

"What does that mean?" Judy asked.

"Well, remember the cell cycle genes that we were talking about earlier? I described the proto-oncogenes as being needed for activating cell division. Well, remember that I also mentioned a class of cell cycle genes that prevent cell division. These genes are called tumor suppressors. You usually have two good copies of each of these tumor suppressor genes, but sometimes you inherit one good copy and one mutated copy. Basically it means that, along with inheriting genes for your red hair or blue eyes, you may have inherited a mutated cell cycle gene. You had it when you were born, so it's not the result of lying in the sun too much or anything like that. But for these types of genes to lead to cancer, you need to have both copies of the gene mutated. One good copy is sufficient to prevent your cells from dividing aberrantly. So you can be born with one mutated copy, but not actually get cancer unless the other copy accidentally gets mutated sometime during your life. Mutations in the second copy could be the result of UV light from the sun, like in the case of melanoma. Since you may have been born with one mutated copy already, you are "predisposed" to getting cancer. You are one step closer to getting cancer compared to someone who doesn't have a mutation. We see a genetic, or hereditary, component in about five to 10 percent of melanoma cases. Do you know if anyone in your family has had melanoma?"

Judy shook her head, "I'm pretty sure that my dad hasn't, but my parents split up when I was young and I haven't really talked to my mom in the last 10 years. I thought I heard that she had some mole thing removed a long time ago, but I didn't think that it was cancer."

The doctor said, "You might want to call her. Now, let's get this biopsy done and hopefully prove that all this talk about cancer is unnecessary."

Questions:

1. Now that you know a little more, what are the risk factors that increase a person's chances of having melanoma?
2. How does sunlight contribute to the development of melanoma?
3. What does it mean to be predisposed to getting cancer? If you inherit a mutated cell cycle gene, does that automatically mean that you will get cancer some day? If you inherit a mutated cell cycle gene and participate in risky behaviors such as sunbathing, does that mean that you will automatically get cancer some day?

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NATIONAL CENTER FOR CASE STUDY TEACHING IN SCIENCE

Drug Wars: An Epic Tale of Asthma and Bacterial Pneumonia



by
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Episode I – The Phantom Asthma Menace

Day 1 (Saturday 10 a.m.)

Ten-year-old Leia was taken to the on-call pediatric clinic that collaborates with her pediatrician's office after a rough night of little sleep with severe wheezing and a frequent, dry cough. During the night, her mother had given Leia albuterol and fluticasone approximately every four hours using an inhaler-spacer delivery method when Leia's coughing was so bad her sleep was disturbed. This was the pediatrician's recommended treatment for when asthma symptoms appeared. Leia had had a runny nose for a few days before the coughing began on Friday evening but no fever.

When Dr. Skywalker saw Leia at the clinic, her mother told him the wheezing and cough began rather suddenly on Friday evening but Leia had no fever, sore throat, head ache, chest pain, or vomiting. She told the doctor that Leia had a history of asthma since the age of five when she was hospitalized with bacterial pneumonia about the time the family moved to New England from France. Leia was up-to-date on all other routine childhood vaccinations except for the pneumococcal vaccine, which Leia had never received. While in France, she had received the BCG vaccine as it was required in France for entry into preschool. Leia's asthma appeared to be triggered only by viral respiratory infections. She did not appear to have any other triggers for asthma, including participation in sports.

Dr. Skywalker noted that Leia's oxygen levels were in the slightly low-normal range. After an albuterol nebulizer treatment, her lungs sounded clear and she was sent home. The doctor recommended continuing both albuterol and fluticasone every four to six hours. Leia continued to improve dramatically over the course of that day and she got lots of rest over the weekend. Leia's mother reduced the albuterol to longer intervals and Leia went to school on Monday, energetic and happy, though she still had a mild residual cough.

Questions

1. List five common environmental triggers for asthma and give at least one specific example for each.
2. Describe the impact of asthma (e.g., morbidity, mortality, economic impact, groups disproportionately affected) on the U.S. population.
3. What is the mechanism of action of albuterol? What is the mechanism of action of fluticasone? Which one is commonly used to treat serious asthma symptoms? Which one is typically used to prevent serious asthma symptoms?

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Episode II – Revenge of the 'Roids

Day 14 (Friday)

Leia started to experience asthma symptoms again. While she was not short of breath, she had a severe, dry, barking cough. Her mother took her to see her pediatrician, Dr. Amidala. Dr. Amidala wasn't available however, and so Leia saw another pediatrician, Dr. Vader, who diagnosed severe asthma but not pneumonia. After taking Leia's age, weight, and other factors into consideration, Dr. Vader prescribed the oral steroid prednisone. On Saturday, Leia complained about the steroid medication. She told her mother she didn't like how it made her feel. On Sunday, Leia had a severe behavioral disturbance that was very uncharacteristic of her. She broke down over a very small problem and even became physically violent. She said the medicine made her feel "frustrated." Because of Leia's strong reaction to the drug, her mother checked the prescription instructions to make sure she was giving Leia the right dose.

Questions

4. How is prednisone different from fluticasone? Is there more of a risk of side effects with prednisone? Why or why not?
5. Could the behavioral problems that Leia experienced be the result of the oral steroid? Briefly describe any evidence for this, including how dosage might factor into the incidence of side effects.
6. Besides Leia's mother possibly giving the wrong dose to Leia, what other types of mistakes could cause Leia to get too much of this medication?

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Episode III – Attack of the Bacterial Clones

Day 17 (Monday a.m.)

Due to the behavioral incident on Sunday, Leia's mother had brought her back to the pediatric drop-in clinic where she was seen by the nurse practitioner, Ms. Yoda. There appeared to be the sound of a fluid infiltrate in the lower right quadrant of Leia's lung. Ms. Yoda diagnosed pneumonia and prescribed amoxicillin (a penicillin derivative). No other diagnostic testing was done. Note that Leia had not exhibited a high or sudden fever at any point during the last few weeks and she had gone to school regularly although she continued to have a mild cough.

Questions

7. What type(s) of bacterial pathogens commonly cause community acquired pneumonia in the U.S.? Make sure to include the full genus and species names, including the name for the pathogen that causes "walking pneumonia."
8. Which of these pathogens should we worry the most about in Leia's particular circumstance? Explain your answer.
9. Which of the vaccines in the recommended childhood vaccination schedule will protect against pneumonia? Include vaccines that protect against viral and bacterial causes of pneumonia.
10. What is the mechanism of action of amoxicillin? What types of common bacterial causes of pneumonia will it work against? What types of common bacterial causes of pneumonia will it not be effective against?
11. None of the healthcare providers so far have ordered a diagnostic test to screen for the type of pathogen (chest X-ray, etc.). Why do you think this is?
12. What problem(s) should we be concerned with when prescribing an antibiotic that may not actually be effective for the type of pathogen that a person is infected with?

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http://textbookofbacteriology.net

MedlinePlus.
Amoxicillin Fact Sheet: http://www.nlm.nih.gov/medlineplus/druginfo/meds/a685001.html

Schauner, S., Erickson, C., Fadare, K. & Stephens, K. (2013). Community-acquired pneumonia in children: A look at the IDSA guidelines. *The Journal of Family Practice*, 62(1), 9–15.

Episode IV – A New Antibacterial Hope

Day 17 (Monday p.m.)

Leia's mother was a microbiologist. Based on the symptoms that Leia had experienced from the beginning of the illness, she was concerned that her daughter has been prescribed amoxicillin instead of azithromycin (a derivative of erythromycin). She called Dr. Kenobi, the chief pediatrician at the practice, to inquire about the rationale behind giving Leia amoxicillin instead of azithromycin.

Questions

13. Why does Leia's mother think that azithromycin should be prescribed?
14. Despite Leia's mild symptoms (lack of fever, no shortness of breath), describe at least two things in Leia's medical history that might warrant treatment against the more serious pathogens that amoxicillin targets?

References

MedlinePlus.
Azithromycin: http://www.nlm.nih.gov/medlineplus/druginfo/meds/a697037.html
Erythromycin: http://www.nlm.nih.gov/medlineplus/druginfo/meds/a682381.html

Epilogue

Days 18–25

Leia improved gradually. However, the antibiotic regimen gave her stomach pain and diarrhea, which resolved with the probiotics recommended by Dr. Kenobi. During the four years following her epic adventures with asthma, steroids, antibiotics, and probiotics, Leia has not had any further asthma symptoms or pneumonia episodes.

Questions

15. What will probiotics do for Leia?
16. What are your thoughts on the number of different health care providers that Leia has seen (including the fact that she was never able to see her actual pediatrician Dr. Amidala)? What are some of the advantages associated with better "continuity of care"?
17. What are some of the best methods for managing childhood asthma?

References

American Academy of Family Physicians.
Continuity of Care: http://www.aafp.org/about/policies/all/definition-care.html

Haggerty, J.L. et al. (2003). Continuity of care: a multidisciplinary review. *BMJ*, 327, 1219–1221.

Christakis, D.A. et al. (2001). Association of Lower Continuity of Care With Greater Risk of Emergency Department Use and Hospitalization in Children. *Pediatrics*, 107(3), 524 –529.

Infectious Diseases Society of America. Infections by Organ System. Community-Acquired Pneumonia (CAP): http://www.idsociety.org/Organ_System/#CommunityAcquiredPneumoniaCAP

American Academy of Pediatrics.
Many resources available, including Pediatric Care Online: https://www.pediatriccareonline.org/
(Search for "asthma")

Merck Childhood Asthma Network.
Changing pO$_2$licy: The Elements for Improving Childhood Asthma Outcomes.
http://www.mcanonline.org/static/images/files_ChangingpO2licyReport.pdf

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A Bad Reaction: A Case Study in Immunology

by
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Part I

You have been awarded a grant in the amount of $1200. Your research team is to use this grant to cover the costs of examining the case histories of three patients. Your goal is to make a diagnosis from these records and design a testable experiment that can be used to obtain future funding. You will not be given much time to examine the three patient histories, so be prepared to take notes and record as much information as you can in the time allowed.

Diagnosis

Your team must deliver:

- A diagnosis for Patient #1 and the major pieces of evidence that you used.
- A diagnosis for Patient #2 and the major pieces of evidence that you used.
- An explanation for why Patient #3 appears normal. What are the major pieces of evidence that you used to account for this?

Each patient record contains a reference number. When recording a piece of evidence to back up your diagnosis of a patient, you must reference the record number that you used to obtain that piece of evidence.

Experiment Proposal

Your team must also produce:

- A testable hypothesis to back up your diagnosis of the three patients.
- A description of an experiment that can be performed to test your hypothesis.

Contents and Costs of Records

Individual records cost $200.00. This is what is available for each patient:

- Medical History—information on lifestyle, surgeries, allergies, and past medical problems.
- Interview transcripts—transcripts taken from interviews with the patients after being admitted to the hospital.
- Vitals and tests—Blood pressure, heart rate, blood counts (CBC), blood gases and results from any tests that were run.
- Organ assesment—assesments of kidney, liver, and pancreatic function.

You have been provided with a sheet that describes the contents of each of the records. Your grant provides you with enough money to purchase six of the 12 records that are available for these three patients.

Evaluation Criteria

The performance of your group will be evaluated on the following criteria:

- Your diagnosis for the three patients and the value of the evidence that you have used.
- Your proposal for your experiment.
- Residual grant funds (spending less money gives you a higher score).

Time Limitations

- All information should be recorded on the data sheets provided.
- Your applications are due at [TIME].

Part II

Transfer of symptomatic peanut allergy to the recipient of a combined liver and kidney transplant

(Instructor's name), Director of Grants and Research at (Hospital name), would like to acknowledge Dr. Christophe Legendre and his team of doctors for their work on identifying the causative agent of a symptomatic peanut allergy acquired by a 35-year-old male recipient of a combined liver-and-kidney transplant. The following report summarizes their work on this case.



A. Introduction

Peanuts are one of the most common causes of food allergy in the United States and Europe. They are also a leading cause of food-induced anaphylaxis and death, which usually follow inadvertent exposures. Allergy to peanuts is an IgE-mediated, mast-cell-dependent, immediate-hypersensitivity reaction. There are numerous reports of the transfer of allergen-specific IgE-mediated hypersensitivity by bone marrow transplantation. We report a case of peanut allergy transmitted through combined liver-and-kidney transplantation.

Questions

A1. What is the difference between an "allergen" and an "antigen"?

A2. What is meant by "anaphylaxis"?

A3. What are the different classes of antibodies that our bodies produce? Which class is associated with the peanut allergy?

A4. What is a mast cell? What role do mast cells play in the immune response?

A5. Hypersensitivities can be described as immediate, subacute, or delayed. How do these sensitivities differ? What evidence did the doctors use to determine that the peanut allergy was an immediate hypersensitivity?

B. Case Presentations

A 22-year-old man with a history of allergic reactions to peanuts was admitted to our hospital in a coma. After inadvertently ingesting satay sauce, which contains peanuts, during a Chinese meal, he had become unwell and had had a cardiorespiratory arrest that resulted in cerebral anoxia, coma, and brain death. A high level of peanut-specific IgE was detected in his serum ... multiple organs were subsequently procured. The donor's HLA phenotype was A1,24;B8,44;DRB1*03,13.

...the donor's liver and right kidney were given in transplantation to a 35-year-old man, and the left kidney and pancreas were given to a 27-year-old woman. The man (HLA phenotype, A2,19;B12,-;DRB1*07,13) had end-stage renal failure.... The woman (HLA phenotype, A1,24;B8,44;DRB1*03,04) had chronic renal failure....

Both transplant recipients received immunosuppressive induction therapy with muromonab-CD3 (OKT3) and corticosteroids, azathioprine, and cyclosporine. Neither had ever had any allergy to peanuts.

Three months after transplantation, the recipient of the liver-kidney transplant reported a skin rash and laryngeal dyspnea after eating peanuts. Allergy to peanuts was diagnosed on the basis of the clinical findings; the absence of specific IgE antibodies before transplantation, their presence at the time the symptoms appeared, and their decline thereafter; and a positive basophil degranulation test.

Questions

B1. What does HLA stand for? What is an HLA phenotype?

B2. How does HLA relate to MHC in immune physiology?

B3. Why is it important to understand the "HLA phenotypes" of the individuals in this case?

B4. From what you know about the structure of an antibody, explain how an IgE can be "peanut-specific."

B5. One way to test for an allergy is to mix a specific allergen with basophils and mast cells from a patient and look for "degranulation." What is occurring when these cells degranulate? How does this become a positive test for a specific allergy?

B6. Why were the patients put on an immunosuppressive therapy after their transplantations?

C. Discussion

The transfer of allergen-specific donor lymphocytes is a likely possibility.... The production of IgE by B cells depends on the presentation of allergens by antigen-presenting cells and on cooperation between B cells and regulatory T-helper lymphocytes of the Th2 type. In our patient there may have been transfer of peanut-specific IgE-producing B cells or of peanut-specific Th2 lymphocytes that induced the recipient's B cells to produce peanut-specific IgE.

Questions

C1. Briefly describe the role of B cells and T-helper lymphocytes in immune physiology.

C2. What is an "antigen-presenting cell" and what role does this type of cell play in an immune response?

C3. Explain the interaction that occurs between a T-helper lymphocyte and a B cell when the B cell is being induced to produce peanut-specific IgE. In your explanation, explain the role that the peanut allergen plays in this interaction.

C4. In immediate hypersensitivity, the initial exposure to an allergen usually does not produce any symptoms. The symptoms, such as those involved in anaphylaxis, usually appear in the second exposure. What events are occurring during this initial exposure that sensitizes a person to an allergen. In your description include the role of B cells, T cells, IgE, mast cells, basophils and the allergen.

Passive transfer of donor IgE is unlikely, because the half-life of IgE is only a few days, whereas the allergic reaction occurred three months after transplantation. However, we cannot rule out the possibility that donor IgE bound to the recipient's mast cells and bosophils could have persisted for more than a few days.

Questions

C5. Describe how IgE binds and reacts with basophils and mast cells.

C6. As described in question C4, the initial exposure to an allergen usually does not produce any symptoms. The symptoms usually appear in the second exposure. What events are occurring during this second exposure? In your description include the role of IgE, basophils, mast cells, and the allergen.

It is relevant that the allergy was transferred from the liver-kidney transplant, but not from the pancreas-kidney transplant. Pluripotent hematopoietic stem cells and dendritic cells are known to be normally resident in the liver. These passenger cells can migrate from the graft to the recipient's lymphoid organs, and multilineage hematopoiesis derived from donor cells can persist for several months after liver grafting.

Questions

C7. Describe the normal physiological role of a "pluripotent hemaotpoietic stem cell" in human physiology.

C8. What is happening when the cells you described in C7 undergo "hematopoiesis?"

C9. Why is it important to note the presence of these cells in the liver when trying to understand the mechanism for how the peanut allergy was transferred to the patient?

C10. In the introduction, the doctors noted well-documented transfers of allergies when bone marrow was being transplanted. Why is this a common occurrence with this type of transplant?

D. Revisiting Patient Records

You have been supplied with the records of all three patients involved in this case. In order to confirm the conclusions of Dr. Christophe Legendre and his group, we will revisit the medical records of these patients to explore evidence in support of their claims.

Questions

Alexander Kolineski, 22-year-old male organ donor.

D1. Review the records for Mr. Kolineski and summarize the evidence to suggest that death was caused by anaphylaxis.

D2. Without reviewing the records from the other patients, can you positively identify the causative agent for this patient's anaphylaxis? Why or why not?

Jonathan Forken, 35-year-old male recipient of a liver and right kidney from Mr. Kolineski.

D3. Review the records for Mr. Forken and summarize the evidence to suggest that Mr. Forken was having a peanut-specific hypersensitivity reaction.

Melissa Jachowiz, 27-year-old female recipient of a pancreas and left kidney from Mr. Kolineski.

D4. Review the records of Mrs. Jachowiz and summarize the evidence to support the fact that she did not obtain a peanut-specific hypersensitivity from her transplant.

Internet Resources

eAllergy.net—A division of Allergy Services Inc. [An extensive collection of allergy resources (best viewed with Internet Explorer).] http://www.eallergy.net/

AtAllergy.com [A resource for understanding allergies; contains a searchable database of articles.] http://www.atallergy.com/allergy/

Food Allergy, Mayo Clinic
http://www.mayoclinic.com/health/food-allergy/DS00082

AAAAI Patient/Public Resource Center-Tips to Remember: Food Allergy
http://www.aaaai.org/patients/publicedmat/tips/foodallergy.stm

Anaphylaxis
http://health.yahoo.net/channel/anaphylaxis.html

Anaphylaxis: MedlinePlus, National Library of Medicine
http://www.nlm.nih.gov/medlineplus/ency/article/000844.htm

Understanding the Immune System, National Institute of Allergy and Infectious Disease
http://www.niaid.nih.gov/topics/immunesystem/pages/default.aspx

Clinical Diagnostic for the Determination of Allergen Induced Basophil Degranulation
http://www.glycotope-bt.com/en/products/diagnostics/basotest_description.php

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A Case Study Involving Influenza and the Influenza Vaccine

by

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Part I—Flu and "Flu"

Karen and Mary work at a grocery store. Mary is a nursing student and works part time to pay for her living expenses. Karen has worked at the grocery for nearly 30 years, since she was 22. The two of them are talking when Karen points to one of the tabloids by the check-out with a headline suggesting that aliens created the bird flu. As their conversation progresses, Mary suggests that Karen should get a shot when the nurses come in next week selling influenza vaccine.

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Karen: No way am I going to waste 15 bucks on another flu shot. I got one last year and I still got sick. Do you remember that horrible sinus infection I had? I was so sick that I missed the Packer's game at Lambeau Field. I had to watch the game at Tom's house because he was having a party. I could barely breathe!

Mary: I remember that you were sick last year, but that wasn't influenza. The influenza virus causes fever, aches and malaise.

Karen: What's malaise?

Mary: That's when you feel sick.

Karen: Well duh, I already told you I was sick.

Mary: But you went to the party to watch the game.

Karen: I was sick, I wasn't dead.

Mary: Look, if you had had influenza you wouldn't have gone out to a party. In fact, you probably wouldn't even have cared to watch the game on TV at home. Malaise is the very sick and weak feeling that comes with having influenza, and it takes all of your energy away and leaves you with no desire to do anything but lie still. That's influenza!

Karen: Well, anyway, Tom also got the flu shot and he still got the stomach flu real bad a couple weeks later. You can't tell me that the flu shot did him any good.

Mary: I can't argue with that. You're right. The influenza vaccine didn't protect him from the stomach flu.

Karen: There! So you admit it!

Mary: I don't admit anything. What you call the stomach flu has nothing to do with the flu shot. The shot is a vaccination that protects against influenza, not vomiting and diarrhea. Some people do get

those symptoms, but influenza is the fever and aches. The stomach flu is caused by other viruses like rotavirus and Norwalk virus; sometimes they're called noroviruses. The influenza vaccine doesn't do anything about those.

Karen: If it doesn't stop you from getting the stomach flu, then what good is the vaccine? And another of my friends says that there are a lot of side effects from getting the flu shot, like allergic reactions, seizures, even autism.

"*That* ought to do it," Karen thought to herself. She wasn't about to lose this argument to a kid of Mary's age.

Questions

1. What are the main symptoms of influenza?
2. Would you expect a flu shot to protect against the "stomach flu"? Why or why not?
3. Identify some of the various causative agents of "stomach flu" and compare them to the influenza virus.
4. Explain how a vaccine provides immunity against infection. Are there any side effects to the influenza vaccine? Should Karen or Mary worry about developing autism?
5. Karen described the upper respiratory infection (URI) that she suffered last year and thinks that her well being is a matter of fate. How many infectious agents cause URI? How can these infections be prevented? How can they be treated?

Part II—Shift and Drift

Mary didn't take the bait; instead of countering Karen's worries about side effects, she chose a different approach.

Mary: Influenza can wipe you out for a week. You won't have the strength to come to work and you would have to take vacation time. Who would take care of your mother at the retirement home if you were sick for a week?

Karen: Oh, come on. A week!?

Mary: The virus can make a person so tired, that once the fever is gone they still won't have the strength and energy to do anything productive for nearly a week. You'd even have difficulty finding the strength to visit your mother for another week.

Karen: Oh my gosh. That would be bad. I guess I remember being that sick about seven or eight years ago. Back then, my mother came over to help me. She wouldn't be able to do that any more.

Mary: So, now do you think you want to get the shot?

Karen: Not so fast; if I got the shot last year, won't I be immune this year?

Mary: The virus changes all the time. The vaccine might protect against the strain of virus that is circulating in the area, but then again, it might not. The new version of the influenza vaccine is designed to protect against the most frequently recognized strains of influenza.

Karen was starting to realize that influenza might really be a different kind of infection than she had thought.

Questions

1. Is it a reasonable gamble for Karen to skip the influenza vaccine this year?
2. What is antigenic drift (or genetic drift)? What is antigenic shift (or genetic shift)?

Part III—Viral vs. Bacterial Infection

Karen was still unconvinced, however Mary had brought up a lot of good points. But even if influenza was a lot more serious than she had thought, a vaccination wasn't a guarantee against illness.

Karen: So, are you telling me that I could get the shot again and still not be protected, because I got sick from some other strain? Then why bother?

Mary: Sure, but the vaccine protects against the most likely viruses. You could still get influenza, but the chances are smaller. You could get the stomach flu, you could get another sinus infection. But by getting the influenza vaccine, you are greatly decreasing your chance of getting very sick this winter.

Karen: Last year when I got sick, I ended up going to the doctor and he gave me some antibiotics. I got better the next day. I could just do that. That way, I only take medicine when I am sick instead of every winter.

Mary: Sorry, but there's a big difference between viral and bacterial infections. The antibiotics helped you feel better because your sinus infection was caused by a bacteria. Antibiotics don't help at all for viral infections. And influenza is a viral infection. Even if the doctor gives you antibiotics, they won't do any good.

Questions

1. Can Karen rely on antibiotics if she gets influenza this year? Why or why not?
2. Compare the effectiveness of vaccines to antibiotics (or other antimicrobials) prior to infection. Compare the effectiveness of vaccines to antibiotics (or other antimicrobials) after the start of symptoms.
3. When are antibiotics effective?

Part IV—Who Should Get Vaccinated?

Karen was still tempted to take the risk; she was generally healthy.

Mary: Besides, if you get the shot, and protect yourself from infection, you won't spread the virus to other people. Consider this; if you became infected, you could spread the virus to your mother and her friends at the retirement home.

Karen: Oh, I would hate to see that happen.

Mary: Did you know that approximately 36,000 people die each year in this country from influenza? That means influenza causes more deaths than breast cancer, and most of the people who die of influenza are elderly.

Karen (sobered by the possibility): So, if I get the shot, I probably won't get sick, but more importantly, I am less likely to pass the infection on to my mom?

If that were the case, then Karen thought it might be worth doing, despite her lingering doubts. On the other hand, she was deathly afraid of needles. If only there was another way to get a flu vaccine ….

Questions

1. Should Karen's mother get an influenza shot, or is she too old?
2. What about Karen's sister who works in a daycare center or Mary's six month old niece?

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