Bacteria, Viruses, and Fungi, Oh My!

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ABSTRACT

As a member of The Gascoigne Lab last summer, my goal was to identify the mechanism of interaction of the proteins Themis and Grb2, and to try to find out if Themis interacts with Cbl, a negative regulator of T cell activation, through Grb2. I successfully created a gene construct for Cbl, ran various combinations of transfections that included each of the proteins alone, each of the protein pairs, and all 3 proteins together. Finally, I immune-precipitated for Themis and ran a western blot for Grb2 and Cbl to confirm their interaction. My lab experience inspired me to create the framework and starting point for a downloadable card game designed to introduce and reinforce human body immune system concepts for high school students. Students will play a collectable card game (*aka* trading card game or customizable card game) in which the cards represent the different "players" in the "immunity" game of life (various pathogens, the skin, interferons, vaccines, antibiotics, antibodies). The game pits a team of "pathogens" against the "immune system." Teachers can modify the game materials to accommodate all levels of high school biology students including English as second language learners up to advanced biology students.

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TEACHER GUIDE

I. OVERVIEW

Concepts covered in this unit

- The fundamental function of the human immune system
- A basic understanding of disease causing pathogens
- The effects of nutrition, sleep, stress, and exercise on the human immune system

General goals of the game – "Bacteria, Viruses, and Fungi, Oh My!"

- Provide teachers with a tool and alternative to a traditional introduction to the human immune system and microorganisms.
- Provide a framework for teachers to customize and expand the game to meet their own needs. It provides a "starter" set of cards as well as templates to create new cards. New cards can easily be created by both teachers and students.
- Provide students with an engaging and fun activity that acts as an introduction to the human immune system in place of a lecture or a textbook.
- Provide students with a motivation to further investigate the human immune system and disease causing agents as a means to add to the game.
- Provide teachers and students with an easy-to-use template to further investigate the human immune system and disease causing agents.
- Provide an emphasis of the connection between daily health choices and the effectiveness of one's immune system.

Recommended placement for the materials within a biology class

- Introduction to the human immune system unit
- Integration into the microorganisms and fungi unit
- Integration into a health unit

Relevance to other science concepts and students' lives

One of the strengths of this "Bacteria, Viruses, and Fungi, Oh My!" is its relevancy to students' lives. First, it serves to dispel fact from fiction regarding pathogen prevention, transmission, and treatment. While access to information has never been easier, a great deal of disinformation regarding the prevention, transmission, and treatment of infectious diseases continues to permeate throughout our society. This game is designed to provide factual and relevant information regarding infectious diseases necessary for all humans to make informed decisions regarding their health.

In addition, new research continues to emerge that connects how our daily decisions about health, nutrition, and exercise can seriously affect our body's ability to fight disease.

II. SCIENCE BACKGROUND

The immune system is the human body's defense against invading pathogens. Pathogens are microorganisms or biological agents that cause disease or illness to the host. They disrupt the normal physiology of a multicellular animal or plant. There are six main types of disease causing agents or pathogens: prions, viruses, bacteria, protozoans, fungi, and parasites. These pathogens vary greatly in size and shape, and also in the type of diseases that they cause in their host. Pathogens can be microscopic

(too small to be seen with the unaided eye) or macroscopic (can be seen with the unaided eye).

In most cases, the immune system does a great job of keeping people healthy and preventing infections, but sometimes problems with the immune system can lead to illness. The immune system can be compared to a military unit defending its territory using a variety of strategies and weapons. Through a series of steps called the immune response, the immune system attacks organisms and substances that invade body systems and cause disease.

There are many factors and variables that can alter the effectiveness of a person's immune system. A person's immune system can greatly be affected by daily choices regarding nutrition, stress management, sleep, and exercise.

Due to the complexity of the immune system, it is difficult to assess the effects of diet on our immune function; however, research results have identified some dietary factors that affect the human immune response (Nutrition and the Immune System. Retrieved from http://www.eufic.org/article/en/artid/nutrition-immune-system). Energy intake seems to have an important influence on immune activity. Undernourished people are at a greater risk from infections. Weight reduction schemes using diets with less than 1200 kcal per day can also reduce immune function, an excellent reason to avoid unhealthy "crash diets." Excessive energy intake may also compromise the immune system's ability to fight infection. Obesity is linked to an increased rate of infectious disease. Furthermore, obese people are more likely to develop coronary heart disease, which has been linked to changes in immune function (Nutrition and the Immune System. Retrieved from http://www.eufic.org/article/en/artid/nutrition-immune-system).

Reducing fat in the diet is important for weight control, but it also seems to influence how well the immune system works. Diets that are high in fat seem to reduce immune response, and thus, increase the risk of infections. Reducing fat content in the diet can

increase immune activity. This might not just affect infections, but it could also strengthen the certain types of immune cells, which fight tumor cells. However, it is not just the amount of fat that is important, but also its origin. It is important to include oily fish, nuts, soy or linseed oil in your diet, because we need the right balance of different fatty acids.

Regular consumption of fermented dairy products such as yogurt may enhance the immune defenses in the gut. Recent research results suggest that yogurts made with certain bacteria (called probiotics) may have a beneficial effect on the immune system (Magee, E., The Benefits of Yogurt. Retrieved from http://www.webmd.com/food-recipes/features/benefits-yogurt). For example, human volunteers who ate yogurt every day made with specific probiotic bacteria showed a higher resistance to microorganisms that cause food poisoning (Magee, E., The Benefits of Yogurt. Retrieved from http://www.webmd.com/food-recipes/features/benefits-yogurt). More research is needed; however, it is clear that immune system maintenance requires a steady intake of all the necessary vitamins and minerals.

The health benefits of a regular exercise program are hard to overstate. It has long been known that maintaining a regular exercise program strengthens the cardiovascular, respiratory, and skeletal systems. Regular exercise throughout the week strengthens your immune system and gives you a better chance to avoid the cold or flu, as well as other serious health conditions like diabetes. Understanding the role exercise plays in keeping your immune system strong is essential to ensure your well-being. Jogging, swimming, walking, or other aerobic activities are commonly regarded as the most beneficial type of exercise for your immune system. While aerobic exercise often receives most of the attention as a way to protect your heart, aerobic activity also strengthens your immune system and significantly decreases your likelihood for viral illnesses like the flu. People who perform regular aerobic exercise also enjoy a reduced risk of diabetes, cancer, stroke, and cardiovascular disease. They also typically live longer than people who do not exercise.

While aerobic exercise like soccer or bicycling lowers your risk for illness, the physical activity also decreases your stress, an enemy of a healthy immune system. Aerobic workouts help reduce stress, anger, and depression by allowing your body to release healthy chemicals called endorphins that aid in relaxation. Some doctors characterize endorphins as natural painkillers. People like to ignore it, but stress is a big deal. In our society, stress can be unrelenting. Stress affects the hormone cortisol produced by the adrenal glands. In small quantities, cortisol is helpful. It is an anti-inflammatory that speeds tissue repair and controls excess immune cell production; however, continued stress raises cortisol levels too high. Too much cortisol slows the production of “good” prostaglandins. “Good” prostaglandins support immune function, dilate blood vessels, inhibit “thick” blood, and are anti-inflammatory. Slowed production allows for the opposite – inflammation and immune suppression. During a period of raised cortisol (from stress), immune system cells disappear from the blood. The part of the immune system most sensitive to increased cortisol levels are the Natural Killer Cells. Immune system function will plummet. Excessive stress, either physical or mental, has a detrimental effect on the optimal functioning of the immune system. It is like the card that finally tips the balance on the house of cards, bringing everything crashing down. Reducing stress benefits more than your immune system, as people with altered mood states are also more likely to suffer fatigue and sleeping problems.

Lack of sleep can also seriously affect your immune system. Studies show that people who do not get quality sleep or enough sleep are more likely to get sick after being exposed to a virus, such as the common cold. Lack of sleep can also affect how fast you recover if you do get sick. During sleep, your immune system releases proteins called cytokines, some of which help promote sleep. Certain cytokines need to increase when you have an infection or inflammation, or when you're under stress. Sleep deprivation may decrease production of these protective cytokines. In addition, infection-fighting antibodies and cells are reduced during periods when you don't get enough sleep. A compromised immune system is not the only effect of sleep deprivation. The symptoms of lack of sleep affect people physically and mentally, and include:

- Irritability
- High Blood Pressure
- Cognitive Impairment
- Decreased Response Time & Accuracy
- Symptoms Similar to ADHD
- Impaired Judgment
- Aches
- Risk of Heart Disease
- Risk of Obesity
- Risk of Type 2 Diabetes

The optimal amount of sleep for most adults is seven to eight hours of good sleep each night. Teenagers need nine to 10 hours of sleep. School-aged children may need 10 or more hours of sleep.

III. STUDENT OUTCOMES

General Description

My lab experience inspired me to create the framework and starting point for a downloadable card game designed to introduce and reinforce human body immune system concepts for high school students. Students will play a collectable card game (*aka* trading card game or customizable card game) in which the cards represent the different "players" in the "immunity" game of life (various pathogens, the skin, interferons, vaccines, antibiotics, antibodies). The game pits a team of "pathogens" against the "immune system." Teachers can modify the game materials to accommodate all levels of high school biology students including English as second language learners up to advanced biology students.

Sample Offense Card **Sample Defense Card**

COMMON COLD

The common cold can be caused by over 200 different kinds of viruses, however the most common is the rhinovirus.

SYMPTOMS

- Sneezing
- Coughing
- Sore Throat
- Mild Headache
- Mild Body Aches
- Runny or stuffy nose

TRANSMISSION

Airborne and direct contact with infected person.

CHALLENGES

Due to the numerous viral strains of the common cold, the human body can never build up resistance and vaccines cannot be developed.

GAME PLAY

Your science lab partner coughs without covering his mouth and you catch his cold - Lose 10 life points for 3 turns

SKIN

The human body's 1st line of defense is the largest organ - the skin. It is a nonspecific defense against pathogens

HOW IT WORKS

The skin defends the body by:

- Acting as a physical barrier
- Oil and sweat glands produce an acidic environment which kills many bacteria
- The top layer of sheds off every second, taking bacteria with it

GAME PLAY

I eat healthy and exercise on a regular basis - as a result I have healthy skin - Block 1 exposure to bacterial pathogens

Basic Game Play

- The game requires at least 2 people (one for each team).
- One person is designated as the offense (pathogens) and the other is the defense (immunity).
- There are 2 decks of cards. One is for the "offense," and the other is for the "defense." The decks are kept separate from each other.
- The offense is trying to kill the defense by reducing their life points down from 500 to 0. (Note: The defense starts the game with 500 life points).
- If the defense makes it to the end of the game with at least one life point, they win the game.
- Each person reads and reviews all of the cards in their deck and chooses 8 cards to start the game.
- The offense starts the game and attacks the defense with one of their eight cards.
- The defense counters the attack.

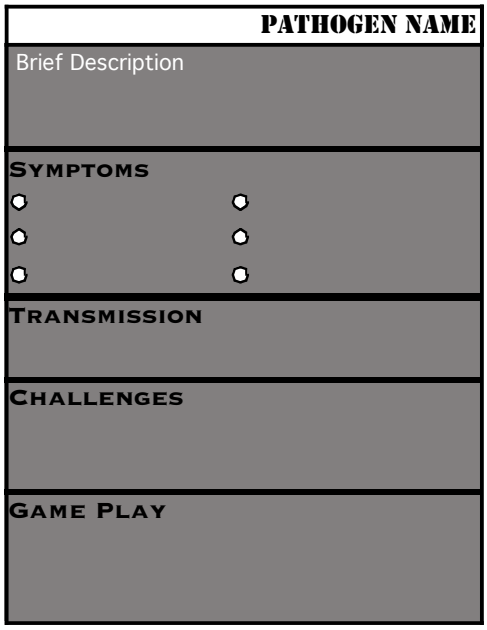
- If the defense plays a card in which they gain life points, they get to review the next 3 cards in their deck and choose one to replace the card they played. The 2 cards that they do not choose get placed at the bottom of their deck.
- The game ends when the offense runs out of cards, or the defense has lost all of the life points.

Curriculum Add-On

- Once students have mastered the card game, students can create new offense and defense cards to add to the game. The game is only limited by the number of pathogens in the world.
- In this curriculum add-on students will not only increase their immunology knowledge base, but they will also work on research and writing skills.

Defense Card Template

Offense Card Template



This unit will:

- Introduce students to the fundamentals of the human immune system.
- Introduce students to the fundamentals of the prevention, transmission, and treatment of pathogens.
- Inform students as to the importance of nutrition, stress management, sleep, and exercise on the effectiveness of one's immune system.
- Help to dispel many of the myths regarding the prevention, transmission, and treatment of pathogens.
- Encourage students to conduct further research on the prevention, transmission, and treatment of pathogens.
- Provide teachers with a tool and alternative to a traditional introduction to the human immune system and microorganisms.
- Provide a framework for teachers to customize and expand the game to meet their own needs. It provides a "starter" set of cards as well as templates to create new cards. New cards can easily be created by both teachers and the students.
- Provide students with an engaging and fun activity that acts as an introduction to the human immune system in place of a lecture or a textbook.

IV. LEARNING OBJECTIVES

Observable and Measurable

A key to winning the game is in the initial card choices of each player. The more familiar the players become with the concepts, the better hand they will choose for themselves at the start of the game. By observing the combinations of card choices, one can evaluate if the students are learning the concepts.

In addition, a great measure of the game's effectiveness is observing the students' motivation to add new cards to the game. This is a clear indication of the game's success or failure to spark students' interest in immunology, pathogens, and health.

Finally, administering a traditional, formal assessment such as a test is a tried and true method of assessing student learning prior to moving onto more advanced human immunology concepts.

V. TIME REQUIREMENTS

Students can easily learn the basic mechanics of the game within 30-60 minutes, however the more familiar the students become with the card content, the better they will learn the specifics of many pathogens as well as the many facets of the human immune system.

VI. ADVANCE PREPARATION

Take the following steps prior to "administering" the game to your class:

- Print out a copy of the instructions and all the cards
- Cut out the cards
- Review the game rules and instructions and PLAYING THE GAME YOURSELF is the best method of familiarizing with the game.
- Students gain the most knowledge from playing "Bacteria, Viruses, and Fungi, Oh My!" in groups of 2 people so print out a set of rules and cards for each group of students.
- *Optional* – laminate the cards and the rules
- *Optional* – use the templates and create additional cards to customize for your student population and curriculum needs

VII. MATERIALS AND EQUIPMENT

This activity is specifically designed and created for the teacher on a VERY tight budget – it is almost FREE!

- Standard white printer paper
- A printer (black and white – no color necessary)

- Scissors

VIII. STUDENT PRIOR KNOWLEDGE AND SKILLS

This activity is intended to act as an introduction to the human immune system and/or microorganisms. It is purposefully designed to be played by students with little to no prior knowledge of the concepts as a fun method and an alternative to traditional bookwork and direct instruction.

Students simply need to know the following:

- The basic function of the human immune system
- The definition of a pathogen

Included in the downloadable game is a pregame quiz created to assess students' prior knowledge and conceptions regarding the transmission, prevention, and treatment of infectious diseases.

IX. CLASSROOM DISCUSSION

Discuss common misconceptions regarding the transmission, prevention, and treatment of infectious diseases such as the following:

- All bacteria and fungi are harmful.
- The flu vaccine will give you the flu.
- Antibiotics are the cure-all for virtually all infectious diseases such as the common cold and the flu.
- Antibiotics can be used to prevent the transmission of pathogens.
- Doctors can diagnose a bacterial infection during physical examination and prescribe antibiotics accordingly.
- It is better to use items that are deemed "antibacterial" (such as antibacterial soaps, toothbrush handles, socks, etc.).
- Foodborne illnesses are caused by spoiled food.
- Your foodborne illness was caused by what you last ate.

- Diseases had already begun to disappear before vaccines were introduced, because of better hygiene and sanitation.
- Vaccines cause many harmful side effects, illnesses, and even death - not to mention possible long-term effects we don't even know about.
- Vaccine-preventable diseases have been virtually eliminated from the United States, so there is no need for my child to be vaccinated.
- Vaccines cause autism.
- It is OK to take antibiotics prescribed for someone else.
- It is OK to stop taking antibiotics early.
- You can get infections or illnesses from sitting directly on a public toilet seat.
- The blowing air from a hand drier in a public restroom spreads germs.
- Antibacterial soap keeps your hands cleaner than regular soap.

BACTERIA, VIRUSES, & FUNGI, OH MY!

How much do you really know about those icky germs and how your body defends itself against them? Do you know fact from fiction?

Objective

This game will introduce you to the fundamental concepts regarding your immune system and the things that try to attack it.

How to play "Bacteria, Viruses, & Fungi, Oh My!"

- The game requires at least 2 people (one for each team).
- Designate one person as the offense (pathogens) and the other as the defense (immunity).
- The are 2 decks of cards. One is for the "offense," and the other is for the "defense." The decks must be kept separate from each other.
- The offense is trying to kill the defense by reducing their life points down from 500 to 0. (Note: The defense starts the game with 500 life points).
- If the defense makes it to the end of the game with at least one life point, they win the game.
- Each person reads and reviews all of the cards in their deck and chooses only 8 cards to start the game.
- The offense starts the game and attacks the defense by throwing one of their 8 cards on the field.
- The defense counters the attack.
- If the defense plays a card in which they gain life points, they get to review the next 3 cards in their deck and choose one to replace the card they played. The 2 cards that they do not choose get placed at the bottom of their deck.
- The game ends when the offense runs out of cards, or the defense has lost all of the life points.

ATHLETE'S FOOT PREVENTION

Athlete's foot is a fungal infection of the skin caused by a parasitic fungus in the genus Trichophyton.

Prevention

- Keep your feet dry and clean
- Dry toes after bathing or swimming
- Wear shower sandals in public showers
- Change socks twice a day
- Allow shoes to air for 24 hours before wearing them again
- Use talcum or antifungal power on your feet

Facts

- Athlete's foot can infect and spread to other areas of the body such as the groin (jock itch)

Game Play

I thoroughly dry between my toes after bathing, regularly use talcum on my feet, and wear sandals in the school locker room shower - block athlete's foot

ATHELETE'S FOOT TREATMENT

Athlete's foot is a fungal infection of the skin caused by a parasitic fungus in the genus Trichophyton.

Treatment

- Daily application of topical medication in conjunction with hygiene measures will cure athlete's foot but it is a long time period - up to 45 days

Facts

- The infection is usually picked up walking barefoot in an infected area or using an infected towel
- Athlete's foot can infect and spread to other areas of the body such as the groin (jock itch)

Game Play

I contract athlete's foot but treat with antifungal cream and good hygiene thus stopping the infection

EXERCISE

It is recommended that teens get 60 minutes of moderate exercise every day. Moderate exercise includes a brisk walk, bike riding, or other similar modes of exercise.

How It Works

- Exercise boosts blood flow to the brain and helps it recieve oxygen and nutrients. The better shape you are in, the faster you fire brain waves for quick thinking.
- Exercise helps use oxygen which burns stored fat and helps maintain a healthy weight reducing the risk of diabetes, heart failure, and stroke.

Game Play

I ran 2 miles everyday after school for a week and aced 3 pop quizes - Gain 20 life points and choose another card

EXERCISE

It is recommended that teens get 60 minutes of moderate exercise every day. Moderate exercise includes a brisk walk, bike riding, or other similar modes of exercise.

How It Works

- Regular exercise maintains a healthy weight, improves skin, strengthens bones & muscles, improves mood, better relaxation, better sleep, and promotes a strong immune system.
- Muscle mass is metabolically active tissue so the more muscle mass your have the more calories you will burn.

Game Play

I learned how to properly and safely weight lift and have now have sexy, rock-hard abs - Gain 20 life points and choose another card

EXERCISE

It is recommended that teens get 60 minutes of moderate exercise every day. Moderate exercise includes a brisk walk, bike riding, or other similar modes of exercise.

How It Works

- Regular exercise maintains a healthy weight, improves skin, stregnthens bones & muscles, improves mood, better relaxation, better sleep, and a promotes a strong immune system.
- Exercise helps use oxygen which burns stored fat and helps maintain a healthy weight reducing the risk of diabetes, heart failure, and stroke.

Game Play

I rode my bike to school all week instead of having my parents drive me - Gain 20 life points and choose a new card

EXERCISE

It is recommended that teens get 60 minutes of moderate exercise every day. Moderate exercise includes a brisk walk, bike riding, or other similar modes of exercise.

How It Works

- Regular exercise maintains a healthy weight, improves skin, stregnthens bones & muscles, improves mood, better relaxation, better sleep, and a promotes a strong immune system.
- Exercise boosts circulation and the delivery of nutrients to your skin, helping to detoxify your body (removing poisons)

Game Play

I joined the school's volleyball team - Gain 60 life points and choose another card

SEASONAL FLU VACCINE

The flu vaccine is the best way to prevent being infected by the influenza virus

How It Works

- The flu vaccine is an inactivated (killed) version of the virus
- Scientists make a new vaccine every year because the flu mutates from year to year
- The vaccine works by stimulating a specific immune response (antibodies) in advance of being exposed to the virus

Facts

- Because the virus is inactivated, it CANNOT cause infection
- The vaccine takes about 2 weeks to become effective
- The seasonal flu vaccine is about 60% effective at preventing the flu

Game Play

I got a flu shot early in the flu season - block one exposure to the seasonal flu

E COLI

Most people recover from an E. coli infection within 5-10 days and without the use of medications.

Treatment

- Treatment of an infection with common E. coli bacteria involves managing complications such as dehydration caused by diarrhea
- Antibiotics are not recommended

Facts

- Diarrhea medications are not recommended because they usually slow the rate at which food and waste products move through the intestines. This may allow more time for the body to absorb the poisons produced by the bacteria and increase the risk of complications

Game Play

I follow my doctor's instruction and recover from an E. coli infection - Treat and stop E. coli

HIV TREATMENT

There is no vaccine or cure for HIV/AIDS, however there are treatment medications called antiretrovirals or ARV therapy.

How It Works

- Taking HIV treatment requires effort and commitment as drugs must be taken at exact times each day.
- The aim of antiretroviral treatment is to keep the amount of HIV in the body at a low level. This stops any weakening of the immune system and allows it to recover from any damage that HIV might have caused already.
- Taking a combination of 3 or more anti-HIV drugs at the same time is called Highly Active Antiretroviral Therapy (HAART). If only one drug was taken, HIV would quickly become resistant to it and the drug would stop working. Taking 2 or more antiretrovirals at the same time vastly reduces the rate at which resistance develops, making treatment more effective in the long term.

Game Play

I take my medications as prescribed and keep my HIV at low levels - Stop losing life points from HIV

INTERFERONS

Interferons are proteins released in response to viral pathogens. They are a nonspecific defense named after their primary function.

How It Works

- Interferons "interfere" with a host cells ability to replicate a virus
- Interferons can slow down the progress of infection and often gives the specific defense of the immune system time to respond

Game Play

I am exposed to a rhinovirus, however
I am eating well, exercising, and getting the proper amount of sleep so my body secretes interferons in response to the exposure, thus preventing me from suffering this virus - Block 1 common cold exposure

INFLAMMATORY RESPONSE

The human body's 2nd line of defense is the inflammatory response. It is a nonspecific defense against pathogens

How It Works

- Blood vessels near the wound expand
- White blood cells leak from the vessels to enter the infected tissue
- The white blood cells detroy the bacteria
- The body temperature can rise causing a fever but also slows down or stops the growth of pathogens

Game Play

My body has a strong immune system due to proper diet and excercise - my body responds with an inflammatory response and my wound heals quickly - Treat and stop a wound infection

HEAD LICE PREVENTION

Lice are parasites that can be found on the human body. Lice found on the human head is called Pediculus humanus capitis.

Prevention

- Never share hair brushes, combs, hair pieces, hats, bedding, towels, or clothing with someone who has head lice
- If you have lice do not go to school until you have been completely treated

Facts

- Lice move by crawling, they cannot hop or fly from person to person.
- Dogs, cats, and other pets do not play a role in lice transmission.

Game Play

I never share brushes, combs, hats, bedding, or towels with anyone - block one lice transmission

HEAD LICE TREATMENT

Lice are parasites that can be found on the human body. Lice found on the human head is called Pediculus humanus capitis.

Treatment

- There are both over-the-counter and presciption products to treat head lice. Permethrin 1% creme rinse or shampoos containing pyrethrins amd piperonyl butoxide are common first treaments.
- A second treatment is needed 1 week after the first treatment to kill newly hatched lice.
- Nit (head lice egg) combs should be used to comb nits and lice from the hair shaft.

Facts

- It may take 4-6 weeks for itching to appear the first time a person has head lice.

Game Play

I contract head lice but treated with them with over-the-counter medications closely following the instructions successfully killing all the lice and their eggs.

BACTERIAL MENINGITIS

Bacterial meningitis can be treated effectively with antibiotics and prevented with vaccination.

Treatment

- Early diagnosis and treatment is important for an effective recovery
- Initially a generous intravenous antibiotic to reduce inflammation is administered until the specific bacteria is determined
- When the specific bacteria are identified, your doctor may decide to change antibiotics

Challenges

The biggest problem with bacterial meningitis is misdiagnosis because symtpoms are very similar to the flu

Game Play

I contract bacterial meningitis but was never vaccinated, however I receive proper antibiotic treatment - Lose 70 life points before recovering

BACTERIAL MENINGITIS

Bacterial meningitis can be treated effectively with antibiotics and prevented with vaccinatior

Treatment

- There are vaccines that prevent most but not all bacterial meningitis in both children and adults
- Vaccination best when administered around age 11 and before the age of 18
- When the specific bacteria are identified, your doctor may decide to change antibiotics

Challenges

The biggest problem with bacterial meningitis is misdiagnosis because symtpoms are very similar to the flu

Game Play

I was exposed to bacterial meningitis but was properly vaccinated - Block bacterial meningitis

MUCUS

One tool in the human body's 1st line of defense is mucus. It is a nonspecific defense against pathogens and is produced by tissues that line the mouth, nose, sinuses, throat, lungs, and gastrointestinal tract.

How It Works

- Mucus traps unwanted substances like bacteria and dust before they can get into the body
- Mucus act as a protective blanket over the above surfaces preventing the tissue from drying out and cracking

Game Play

I maintain a healthy diet and as a result I secrete the proper amount of mucus - Block 1 air-born bacterial attack

SKIN

The human body's 1st line of defense is the largest organ - the skin. It is a nonspecific defense against pathogens

How It Works

The skin defends the body by:

- Acting as a physical barrier
- Oil and sweat glands produce an acidic environment which kills many bacteria
- The top layer of sheds off every second, taking bacteria with it

Game Play

I eat healthy and exercise on a regular basis - as a result I have healthy skin - Block 1 exposure to air-born bacterial pathogens

NUTRITION

Due to the complexity of the immune system, it is difficult to assess the effects of diet on our immune function. However, research results have identified some dietary factors that affect the human immune response.

How It Works

- Energy intake seems to have an important influence on immune activity. Undernourished people (too few calories) are at greater risk from infections.
- Weight reduction schemes using diets with less than 1200 kcal per day can also reduce immune function, an excellent reason to avoid unhealthy "crash diets".

Game Play

I have been eating healthy balanced meals 3 times a day consisting of whole foods and not skipping - Gain 20 life points and choose another card

NUTRITION

Due to the complexity of the immune system, it is difficult to assess the effects of diet on our immune function. However, research results have identified some dietary factors that affect the human immune response.

How It Works

- Excessive energy intake (too many calories) may also compromise the immune system's ability to fight infection. Obesity is linked to an increased rate of infectious disease.
- Obese people are more likely to develop coronary heart disease, which has been linked to alterations in the immune function.

Game Play

I have been eating healthy balanced meals 3 times a day consisting of whole foods and not eating sugary and fatty snacks when I am bored - Gain 20 life points and choose another card

NUTRITION

Due to the complexity of the immune system, it is difficult to assess the effects of diet on our immune function. However, research results have identified some dietary factors that affect the human immune response.

How It Works

- Diets high in fat seem to depress the immune response and increase the risk of infections.
- Obese people are more likely to develop coronary heart disease, which has been linked to alterations in the immune function.
- Diets high in fat seem to depress the immune response and increase the risk of infections. Reducing saturated fats in the diet can increase immune activity.

Game Play

I have been eating healthy fats such as fish oils, nuts, seeds, and avocado - Gain 20 life points and choose another card

SLEEP

In spite of thousands of sleep studies, scientists still are not sure why we need sleep, however we do know that all mammals need sleep to survive.

How It Works

- The body releases hormones that allows the body to make us “sleepy” at night and awake during the day - this is called the “circadium rythum”
- There are 2 main types of sleep:

Non Rapid Eye Movement (NREM)

The final stage of NREM is the most nourishing and restfull

Rapid Eye Movement (REM)

This is the stage where most dreaming occurs and our brains are most active even though we are fast asleep

Game Play

I turned off the computer, the TV, stopped texting & playing video games and got the recommended 9 hours of sleep for a teenager - Block a loss of sleep attack

STRESS REDUCTION

Stress is the body's reaction to any change that requires an adjustment or response. The body reacts to these changes with physical, mental, and emotional responses.

How It Works

- Stress becomes negative when a person faces continuous challenges without relief or relaxation between challenges. As a result, the person becomes overworked and stress-related tension builds.
- Stress can play a part in problems such as headaches, high blood pressure, heart problems, diabetes, skin conditions, asthma, arthritis, depression, and anxiety.

Game Play

I attended yoga class - Gain 10 life points and choose another card

STRESS REDUCTION

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Benefit

I learned how to meditate - Gain 40 life points and choose another card

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Game Play

I talked to the school counselor to learn how to better cope with the daily stresses of life - Gain 40 life points and choose another card

TETANUS TREATMENT

No lab test exists to confirm tetanus so diagnosis is based on a physical examination and tests to rule out infections with similar symptoms

Treatment

- Antibiotics
- Medicine to reverse the toxin
- Bedrest
- Muscle relaxers
- Sedatives
- Surgery to clean the wound and remove the source of the poison (debridement)

Facts

- Without treatment, one in four people die from tetanus

Game Play

I did not stay current on my tetanus booster vaccine and contracted tetanus - lose 40 life points per turn until treated with antibiotics

TETANUS VACCINE

The tetanus vaccine is a type of “active” immunity and is used to prevent an individual from contracting tetanus.

How It Works

- The tetanus vaccine is composed of inactivated toxins and is used to preventian individual from contracting tetanus.
- The vaccine works by stimulating a specific immune response (antibodies) in advance of being exposed to the virus

Facts

- The tetanus vaccine is 100% effective
- Because the virus is inactivated, it CANNOT cause infection
- To be effective, the vaccine requires a booster shot every 10 years

Game Play

I received my 10 year booster shot and avoided suffering from a tetanus exposure.

POOR NUTRITION

Due to the complexity of the immune system, it is difficult to assess the effects of diet on our immune function. However, research results have identified some dietary factors that affect the human immune response.

How It Works

- Energy intake seems to have an important influence on immune activity. Undernourished people (too few calories) are at greater risk from infections.
- Weight reduction schemes using diets with less than 1200 kcal per day can also reduce immune function, an excellent reason to avoid unhealthy "crash diets".

Game Play

You decide to skip meals to try and lose weight - you end up tired all the time and catch a cold subsequently your grades fall - Defense loses 60 life points

POOR NUTRITION

Due to the complexity of the immune system, it is difficult to assess the effects of diet on our immune function. However, research results have identified some dietary factors that affect the human immune response.

How It Works

- Excessive energy intake (too many calories) may also compromise the immune system's ability to fight infection. Obesity is linked to an increased rate of infectious disease.
- Obese people are more likely to develop coronary heart disease, which has been linked to alterations in the immune function.

Game Play

You eat cookies and ice cream when you are stressed insted of dealing with your feelings - gain 7lbs and weaken your immune system -- Defense loses 40 life points

POOR NUTRITION

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How It Works

- Diets high in fat seem to depress the immune response and increase the risk of infections.
- Obese people are more likely to develop coronary heart disease, which has been linked to alterations in the immune function.
- Diets high in fat seem to depress the immune response and increase the risk of infections. Reducing saturated fats in the diet can increase immune activity.

Game Play

You eat fast food once a day for a month and weaken your immune system and end up with the flu - Defense loses 40 life points

E. COLI

Escherichia coli bacteria normally live in the intestines of people and animals. Most are harmless and are an important part of a healthy intestinal tract, however some can make you sick.

Symptoms

- Vomiting
- Stomach Cramps
- Diarrhea

Transmission

Infections start when you swallow tiny (usually invisible) amounts of human or animal feces. This usually is due to contaminated food, unpasteurized dairy products, or water that has not been disinfected.

Challenges

Everyone is at risk because washing hands prior to food preparation is often neglected.

Game Play

You eat peanut butter contaminated with E. coli - Lose 30 points for every turn until your E. coli defense card is played

COMMON COLD

The common cold can be caused by over 200 different kinds of viruses, however the most common is the rhinovirus.

Symptoms

- Sneezing
- Coughing
- Sore Throat
- Mild Headache
- Mild Body Aches
- Runny or stuffy nose

Transmission

Airborne and direct contact with infected person.

Challenges

Due to the numerous viral strains of the common cold, the human body can never build up resistance and vaccines cannot be developed.

Game Play

Your science lab partner coughs without covering his mouth and you catch his cold - Lose 10 life points for 3 turns

SALMONELLOSIS

A bacterial infection caused by the bacteria Salmonella

Symptoms

- Diarrhea
- Fever
- Abdominal Cramps
- Infection can spread from the intestines to the bloodstream and to other body sites

Transmission

Salmonella lives in the intestinal tract of animals including birds and is usually transmitted to humans by eating foods contaminated with feces or if it is present on raw meat or poultry if the product is not cooked to a safe internal temperature.

Challenges

Strains that cause no symptoms in animals can make humans sick

Game Play

Most people recover without treatment within 4-7 days - lose 30 life points for 4 turns

TETANUS

Also known as “lock jaw”, it is an infection of the nervous system caused by the bacteria Clostridium tetani

Symptoms

- Locking of the jaw
- Drooling
- Painful tightening of muscles
- Excessive sweating

Transmission

The bacteria live in soil, dust, saliva, and manure. They will enter the body through a deep cut - usually a puncture wound

Challenges

The bacteria spores release a toxin that blocks nerve signals from the spinal cord to the muscles

Game Play

You wore uncomfortable shoes to school to impress your friends and decide to walk home barefoot - you step on a rusty nail - lose 20 life points for every turn until you get a tetanus shot

SEASONAL INFLUENZA

A contagious respiratory illness caused by influenza viruses A and B that infect the nose, throat, & lungs.

Symptoms

- Fever/chills
- Runny/stuffy nose
- Fatigue
- Sore throat
- Muscle/body aches
- Coughing
- Headache
- People may have vomiting and diarrhea, though this is more common in children than adults.

Transmition

Air-born; droplets from sneezing and coughing; direct contact with infected person.

Challenges

The flu is an RNA virus which enables the virus to mutate rapidly.

Game Play

You are exposed to the seasonal influenza - Lose 200 life points unless you are vaccinated

ATHLETE'S FOOT

Athlete's foot is a fungal infection of the skin caused by a parasitic fungus in the genus Trichophyton.

Symptoms

- Scaling, flaking, and itching of the skin
- The condition usually effects the feet but can spread to other areas of the body including the groin.

Transmission

The fungus is generally picked up through walking barefoot in an infected area or using an infected towel, however to incubate, the fungus needs a warm, moist environment such as a shoe.

Game Play

You walked barefoot in the locker-room shower picking up the fungus. In addition you did not dry your feet before putting on your shoes thus allowing the fungus to grow - lose 20 life points per turn until treated with a pharmaceutical cream.

HEAD LICE

Lice are parasites that can be found on the human body. Lice found on the human head is called Pediculus humanus capitis.

Symptoms

- Intense itching of the scalp
- Small, red bumps on the scalp, neck, and shoulders (bumps may become crusty and ooze)

Transmission

- Close contact with a person who has lice
- Touching the clothing or bedding of someone who has lice
- Share hats, towels, brushes, or combs of someone who has lice

Game Play

Instead of completing an assignment in class, you borrow a friend's brush to fix your hair and contract head lice - lose 20 life points every turn until treated with a shampoo containing 1% permethrin (NIX).

BACTERIAL MENINGITIS

Bacterial meningitis occurs when bacteria infects the covering of the brain & spinal cord

Symptoms

- Flu-like symptons
- Severe headache
- Stiff-neck

Transmission

Direct contact only via an infected person's oral or respiratory secretions. Most of the bacteria that cause meningitis are not as contagious as diseases such as the common cold or the flu.

Complications

It attacks at a rapid pace and is often mistaken for influenza. Infection can result in permanant brain damage, paralysis, blindness, hearing loss, or even death within several hours of onset

Game Play

You are exposed to bacterial meningitis - Lose 60 life points for every turn unless you are vaccinated or until you are properly diagnosed and treated

MRSA

Methicillin-resistant Staphylococcus aureus is a bacterium responsible for several difficult to treat infections

Symptoms

- Small red bumps on the skin
- Fever
- Skin bumps progressing to boils

Transmission

- Most commonly found in the nostrils, the respiratory tract, open wounds, and the urinary tract.
- Transmission occurs from direct contact with a person or object contaminated by the bacteria

Challenges

MRSA is resistant to beta-lactum antibiotics which include the penicillan and the cephalosporins

Game Play

While in the emergency room from stepping on a rusty nail you contract MRSA - Lose 30 life points for every turn until the doctor finds an effective antibiotic

HUMAN IMMUNODEFICIENCY VIRUS

HIV is a virus that causes the breakdown of the immune system. People become sick from infections that would not normally affect them

Symptoms

- Flu-like symptoms
- Joint pain
- Skin rash
- Weight loss
- Confusion
- Swollen lymph nodes
- Nausea/vomitting
- Dry cough
- Pneumonia
- Yeast infections

Transmission

Fluid-to-fluid contact via semen, blood, or breast milk

Challenges

HIV has few or no symptoms for up to 10 years or more before symptoms of AIDS develope

Game Play

You had unprotected sex & contracted HIV - Lose 50 life points every turn until you get treatment

NO EXERCISE

It is recommended that teens get 60 minutes of moderate exercise every day. Moderate exercise includes a brisk walk, bike riding, or other similar modes of exercise.

How It Works

- Lack of exercise is the reason behind many chronic health conditions that effect both the quality and the length of your life.
- Lack of exercise can lead to; diabetes, heart failure, weight gain, and depression (just to name a few).

Game Play

You play 2 hours of video games instead of exercising and consequently lose sleep and fail 3 quizzes - Defense loses 60 life points

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Game Play

You quit the school's swim team and gain 10 lbs - you can't button your jeans - Defense loses 40 life points

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Game Play

You spend 2 hours texting with your BFF instead of going for a 2 hour walk with that person where you could have had the same conversation and benefitted from exercise - Defense loses 40 life points

LACK OF SLEEP

In spite of thousands of sleep studies, scientists still are not sure why we need sleep, however we do know that all mammals need sleep to survive.

How It Works

- The body releases hormones that allows the body to make us “sleepy” at night and awake during the day - this is called the “circadium rythum”
- There are 2 main types of sleep:

Non Rapid Eye Movement (NREM)

The final stage of NREM is the most nourishing and rest-full

Rapid Eye Movement (REM)

This is the stage where most dreaming occurs and our brains are most active even though we are fast asleep

Game Play

You stayed up until 2am on Facebook which leads to a short temper and inappropriate behavior in school - defense loses 30 life points

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Rapid Eye Movement (REM)

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Damage

You stayed up until 2am playing World of Warcraft and limit your ability to learn, listen, solve problems, and concentrate - Defense loses 40 life points

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Game Play

You get in an argument with your parents and instead of managing your anger you punch a wall and lose 10 life points

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Game Play

You fail to get help with your test anxiety - defense loses 30 life points

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Game Play

You are focused on your social life instead of studying and fall very far behind on homework. Defense loses 10 life points