

Lab 5 Immunity and Nutrition

(June 2014)

Section 1 - Bacteria

[2] For today's lab, we'll go through some of the basics of human health – a few of the common disease-causing agents, immunity and nutrition. I can pretty much sum up the lab by saying “wash your hands and eat more vegetables”, but that's not really enough knowledge for a college-educated person like yourself, so let's get to some of the details, starting with bacteria.

[3] The first thing you should appreciate about bacteria is that they are everywhere. You can find bacteria in every temperature from Arctic ice to the hottest boiling hot pool, in every level of pH, and every oxygen condition. Each species has evolved a complex chemistry suited to each of those environments.

[4] We looked at the basic cell structure of bacteria last week and you saw that bacteria are pretty simple in construction, but you should realize that they are extremely efficient at growing and dividing. When an organism is that small, it doesn't take much in the way of nutrients and oxygen to keep them going, and as long as they have food, they can reproduce asexually perhaps as often as every 20 minutes.

[5] Some bacteria require oxygen to grow, just like we do, and these are called “aerobic” bacteria. Some bacteria, however, don't need oxygen at all because they use a different chemical system for respiration that allows them to live in oxygen-free environments. These types of bacteria are called “anaerobic”. Record the two types of bacteria in your lab book.

[6] An example of an anaerobic species is *Clostridium botulinum*. Because this species doesn't need oxygen, it can live inside a sealed can of food. These bacteria can release a deadly toxin and could kill someone who unknowingly ate that food. You may have heard of this toxin in another context, when it is used in very small doses to paralyze facial muscles, which cosmetically reduces the appearance of wrinkles. In this form the toxin is called “botox”.

[7] Another way we can classify bacteria is by their shapes. Record the three different bacterial shapes by drawing the cocci, bacilli and spirals in your lab book.

[8] Although bacteria have a reputation for causing diseases, very few actually do. If they do cause disease, they are called “pathogens” a term which comes from the Greek roots “to give birth to” and “suffering”. Here is a listing of some bacterial diseases you may have heard of. Please record at least four of these diseases in your lab book and record the definition of pathogen before we go on.

[9] Almost all the other bacteria found on earth are completely harmless. In fact, humans generally carry quite a few around on a regular basis, and these are called our “normal flora” or sometimes our “microbiota”. It's a good thing we do carry around so many kinds of bacteria, because the more regular, harmless bacteria we have along for the ride, the less chance a pathogenic species will be able

to gain a foothold. Take a minute and describe the difference between normal flora and pathogens before we continue.

[10] There are roughly 1000 species of bacteria that live on the outside of

[37] The red blood cells, also known as RBCs, are very odd little cells. They only have one job - carry oxygen to the body's tissues, then take away the waste carbon dioxide. To do this single job, they don't need to grow, divide or produce any molecular products, so they don't contain any special organelles like mitochondria or ribosomes, and they don't even have nuclei. 95% of a red blood cell is hemoglobin, a protein that carries oxygen and carbon dioxide.

[38] The white blood cells, the WBCs, are what keep us healthy. They are our internal defense system as well as the clean-up crew when our cells are worn out. There are five types of white blood cells with fully functional organelles including nuclei.

[54] Smoke can also wreak havoc on your skin. Years of damage to DNA and membranes results in less blood flow to the skin, starving the skin of nutrients and oxygen. Smoking also increases an enzyme which breaks down collagen, a molecule which keeps your skin smooth and flexible. Collagen naturally decreases as we age, so smoking in essence speeds up the aging process, resulting in a wrinkly, gray “Smoker’s Face”. Record the cellular damage done to skin by smoking in your lab book.

[55] Here’s a list of diseases in which smoking has some role. Now you can see why one of the first questions a doctor asks you is if you smoke. Record at least three of these diseases in your lab book.

Section 5

Section 6 - Health Decisions - Energy Needs

[63] Thank you Professor Farris. This next portion of the lab deals with nutrition. I'm sure you have all heard the old saying, "You are what you eat." Since you are all familiar with the organic molecules we studied in Lab 3, you can probably figure out that the molecules that make up your body come from the food you eat.

[64] Well, how many molecules do you need in a healthy body? If you ever listen to the news you have heard about the epidemic of obesity facing the country. How do you know if you are or aren't a healthy weight?

[65] One simple way of determining where you stand health wise with your weight is to calculate your BMI or body mass index. There are several ways to determine this, but we will use a simple calculation that uses your height and weight. At this time I am going to ask you to calculate your BMI in the first part of Section 6. If you don't want to use your actual numbers in the lab manual it's OK, but you should know your true BMI for your own information so calculate it for yourself. Once you have calculated your BMI come right back to the program.

[66] Now that you have a number for your BMI, compare it to those shown here. Within which category does your BMI fall? Record this in your lab manual below your calculation. Because this calculation does not tell you about your percent of body fat it may not always be a definitive picture of your health.

[67] You might be thinking -"OK, so what if I am a little overweight?" As you learned in the first part of this lab, there are many causes of diseases, and being overweight is always a factor. Here you can see just a few of the problems carrying too much weight can cause. Also, you can see the increase of obesity in the United States from these maps. This is a definite health care concern.

[68] Time to get up and take a stretch! Go over to the demonstration table and look at the fat model there. How much do you think that fat blob weighs? Take a guess, record it in your lab manual and

