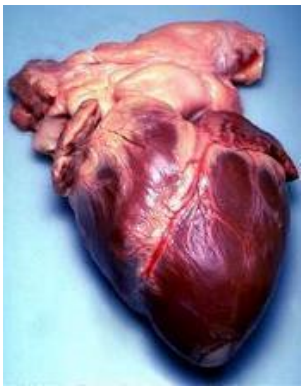
Human Body System Lab Packet

Name _____

Circulatory System Lab



Introduction

An average-sized adult has about 5.5 liters of blood in their body, which the heart *circulates* about three times every minute. Your heart is constantly beating—even before birth!—to keep the blood circulating. The heart of an average 65-year-old person has contracted more than 2.5 billion times. That is a lot of heartbeats! You can see a picture of a real human heart.

Experts on cardiac health tell us that the best ways to keep our hearts healthy are through a balanced diet, avoiding smoking, and regular exercise. Exercise that is good for your heart should elevate your *heart rate*. Heart rate is a measure of how many times a person's heart beats in a minute (*beats per minute*, or *bpm*). But by how much, for how long, and how often should your heart rate be elevated? This has to do with how fit you are and your maximum heart rate, which is 220 bpm minus your age. For example, if you are 30 years old, your maximum heart rate would be 190 bpm (since 220 minus 30 equals 190). The American Heart Association recommends that you do exercise that increases your heart rate to between 50 and 85% of your maximum heart rate. This range is your target heart rate zone. They recommend getting at least 30 minutes of moderate to vigorous exercise most days (or a total of about 150 minutes a week).

What is your resting heart rate? What types of exercises work to elevate your heart rate? How do you feel when your heart is working at 50% of its maximum rate? How about when it is working at 75% of its maximum rate?

Questions to think about: Yes you should answer these questions

1. What is the average maximum heart rate for someone your age? _____
2. What is the range recommended for heart rate during exercise? _____
3. How much exercise does your body need each week for good cardiovascular health? _____

Measuring Your Heart Rate

Use the first two fingers of one hand to feel your radial pulse on the opposite wrist, as shown in the picture. You will find it on the "thumb side" of your wrist, just below the base of your hand. Practice finding your pulse. *Note:* Do not use your thumb, because it has its own pulse, which could throw off your count.

Your heart rate is the number of beats per minute, but you do not have to count for a full minute to get an accurate heart rate. Counting the number of beats in either 10 or 15 seconds is fine. As practice, right now use a clock or timer to time your count, and write down the number of beats you counted _____. Now calculate the number of beats per minute (bpm) to get your heart rate. If you counted for ten seconds what do you need to multiply by to get the number of beats per minute? How about if you counted for 15 seconds? That is it! Write down your *resting heart* rate: _____ bpm

Activity and Heart Rate

Your resting heart rate is your heart rate when you are awake but relaxed, such as when you have been sitting still for several minutes. You will be measuring your heart rate during one of the three different types of physical activity. You team members will also

do one of the three activities. Together your team will do all three activities. When you do each activity, record the number of beats you count in 10 seconds (s). Later you will calculate the beats per minute (bpm) from this. **Your resting heart rate will be what you measured above.** Record the data in Table.

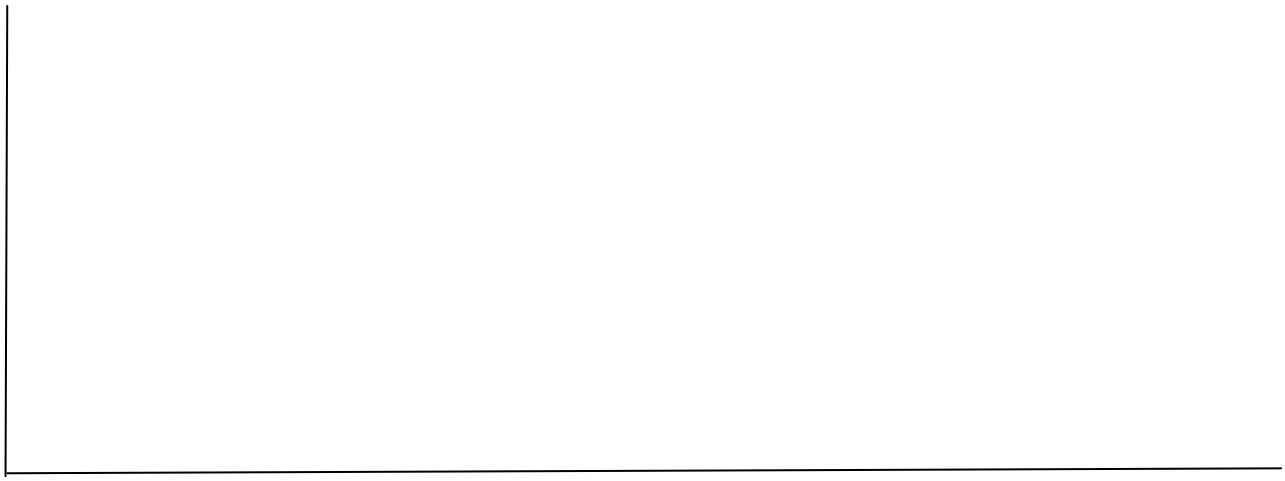
Activity	Who Did it	Time									
		O (Rest)		1 min		2 min		5min		10 min	
		Beat 10s	bpm	Beat 10s	bpm	Beat 10s	bpm	Beat 10s	bpm	Beat 10s	bpm
Walking											
Jumping Jacks											
Jogging in place											

Perform the activity for 10 minutes. In the data table, write down the number of beats you count in 10 seconds at the times indicated in Table (after 1, 2, 5 and 10 minutes of activity).

Once you are done with the activity, calculate the heart rate after 1, 2, 5 and 10 minutes of activity by multiplying the number of beats you counted (in 10 seconds) by six. This is the heart rate in beats per minute (bpm). Share data with the team.

Make line graphs of heart rate (on the y-axis, in bpm) vs. time (on the x-axis, in minutes) for each activity.

Graph



Questions

1. Which activity increased heart rate the most (highest peak)? _____
2. Which activity increased the heart rate the fastest (greatest slope)? _____

3. Which activity elevated the heart rate closest to the target heart rate zone (50-85% of maximum heart rate)? _____

Muscular System Lab

Finger marathon

Learning goals:

- I can investigate how muscles use energy during exercise
- I can discuss the link between repetition and muscle fatigue
- I can accurately record and display the data they collect.

Introduction/background

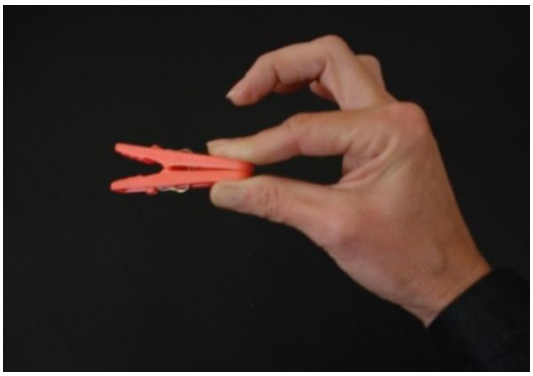
The aim of this activity is to demonstrate muscle fatigue. In the early stage of this activity, the cells are using energy generated from aerobic respiration (using oxygen and releasing carbon dioxide). The muscle fibers that carry out this oxygen-involving respiration are called slow twitch muscle fibers.

After a while, oxygen can't be delivered fast enough to these muscle fibers and fast-twitch muscle fibers are recruited, which are able to release energy through anaerobic respiration (respiration that doesn't need oxygen). The downside of this reaction is that less energy is produced and the waste product is lactic acid. When lactic acid accumulates in the muscle, it interferes with muscle contraction – students become aware of a 'burn' as lactic acid builds up.

In the recovery stage (when students are having a rest), oxygen is restored to the muscles and the lactic acid is removed from the muscles cells by the blood.

Most people don't exhaust their supply of energy because muscular fatigue and pain usually cause them to stop their activity. Marathon runners may push beyond pain and sometimes they collapse because there is no more energy to keep their muscles moving.

Student handout: Fast fingers



1. Work in pairs. One of you will open/close the pin and one will keep the time, then you will change roles.
2. Hold the clothes pin comfortably with the thumb and forefinger of the hand you write with.
3. Practise quickly opening and closing the clothes pin for a few seconds. (Make sure you open it all the way each time.)
4. Your timekeeper will count the number of times you can open the clothes peg in 30-second intervals. When the timekeeper says go, open and close the pin as fast as you can and count out loud each time you open the pin. Write the score here.

Person's name	30 seconds	60 seconds	90 seconds

5. Switch roles and write the score above.
6. Draw and plot a graph of the two sets of results.
   - x axis = 30 s, 60 s, 90 s
   - y axis = number of squeezes per 30 s interval

Questions:

1. Do the graphs show any difference in the number of squeezes students were able to do?

_____

_____

2. Describe the feeling in their finger muscles during the different stages.

_____

_____

3. Using your graphs, predict the interval (in blocks of 30 seconds) when you would no longer
   be able to squeeze the clothes pin. What is that interval _____
   Prove it! carry out an experiment to test this prediction.

4. Describe an experiment to answer the question: Is there a difference between the writing
hand and the non-writing hand?

_____

_____

5. Design an experiment to answer one of the following question: Is there a gender difference
in finger muscle fatigue?

_____

_____

Nervous System Lab

Reactions versus Reflexes Lab

Background:

Have you ever had to react to a situation where something was flying at your face? If so, you probably used two of our body's most important – as well as fastest – mechanisms for protecting your eyes: reflexes and reactions. You automatically closed your eyes as the object approached and you may have ducked your head out of the way.

Closing your eyes automatically is a reflex. A reflex is an autonomic (or involuntary) response to a stimulus that helps to protect the body from injury. Reflexes are very rapid and of short duration since they do not rely upon the brain for "decision making". This entire "decision" to react occurs in the spinal cord or brain stem.

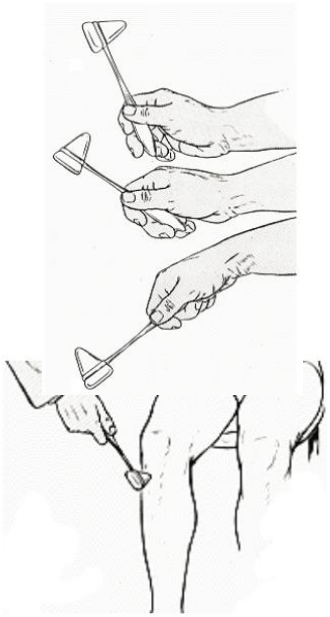
Other types of reflexes happen all the time. In fact, your last visit to the doctor probably involved one. When struck just below the knee with a small hammer, your lower leg "kicks" up to protect the ligaments inside the knee capsule and to keep your quadriceps from being stretched too far. If you pick up something very hot, you may drop it to prevent a serious burn. All of these are examples of reflexes.

Ducking your head out of the way is a reaction. A reaction is a somatic (voluntary) response to a stimulus. This decision involves the brain and requires the brain to make a decision about what your response will be. A reaction is the deliberate or voluntary changing of the body's position to respond to the stimulus. Reactions may also be very quick and of short duration, but they aren't always.

Purpose: the purpose of this laboratory experience is:

- ✓ to understand the difference between a reflex and a reaction
- ✓ to demonstrate some human reflexes
- ✓ to be able to calculate your reaction time

Patellar or Knee Jerk Reflex (2 people in the group do and share data)



1. The subject is to sit on the edge of the lab table with the leg s able to swing freely. (One partner will be the subject first and the other partner the tester, then you'll switch.)
2. Once the legs are relaxed and swing freely, the tester should use the side of their hand to "tap" the subject just below the knee cap. What happened? Record your results in the data table.
3. Now have the person sit with their leg straight out. Tap the knee in the same place. Observe and record your results.
4. Switch places with your partner and repeat steps 1-3.

Papillary Reflex (2 people in the group do and share data)

5. Have the subject close his or her eyes for one minute (no peeking). After one minute, stare into the subject's eyes and tell him/her to open his/her eyes. Observe and record what happens to the pupils.
6. After the subject has been tested switch places and repeat with the partner.

Record the data in the data table.

Babinski's Response (2 people in the group do and share data)

7. Have the subject remove one shoe and sock. Have the subject sit on the lab table with his/her foot extending just over the edge. Using a pen cap or fingernail, the experimenter is to scratch the subject's foot in one smooth stroke motion from toe to heel.
8. Describe the response in the toes in your data table.
9. After the subject has been tested switch places and repeat with the partner.

Blink Reflex (2 people in the group do and share data)

10. Have the subject hold a sheet of clear plastic (transparency) in front of their face. Crumple up a small piece of paper and toss it toward their eyes. Observe what happens and record your data.

11. After the subject has been tested switch places and repeat with the partner.

Stimulus	Student Response & Name	Student Response & Name
Knee tap (bent leg)		
Knee tap (straight leg)		
Pupil Response to light		
Touching toe to heel		
Object moving toward face		

1. Why doesn't the patellar reflex happen when your leg is straight? _____

_____

2. How does the patellar reflex protect us? _____

3. How does the papillary response prevent injury?

_____

What would happen without it?

_____

4. Why is the blinking response effective? _____

What kind of job would you have where you used this reflex quite often?

_____

_____

5. What kind of job would you have where you would want to stop the blinking response?

_____

6. Name three sports or occupations where having a fast reaction time are important.

_____

7. Give three examples of things that could slow down your reaction time or reflexes.

_____ _____ _____

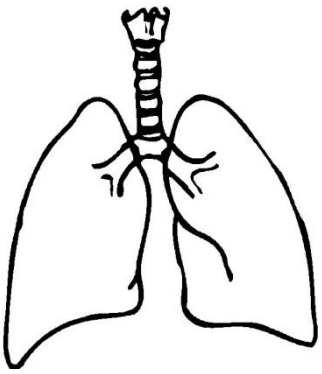
8. Say that a person catches a meter stick very slowly when their hands are cold. If that

person was able to average catching the meter stick at 93 cm, what is their reaction time?

Show your work

_____

Respiratory System Lab



Breathing Rate Investigation

Background Information: Oxygen is essential to life. We use the oxygen we breathe and the food we eat to produce energy, which our cells can use. Physical activity increases our need for energy; increasing the use of oxygen and nutrients.

The body can store some of the things it needs to function. Some animals have the ability to store oxygen for long periods of time allowing them to hold their breath. However, humans can only store oxygen for a very short period of time.

At rest, the blood holds about a quart of dissolved oxygen, but it is constantly being used by the cells to transform energy during cellular respiration. The respiratory system must work all of the time to supply enough oxygen to the body.

Question: What is the effect of exercise on breathing rate?

Hypothesis: Make a prediction about the effects exercise on breathing rate. EXPLAIN the reason for your prediction.

_____

_____

_____

Procedure:

1. **Determine your <u>resting</u> breathing rate**. Sit down and breath normally. Use a clock or stopwatch to time a 1 minute time period. During this time, count the number of times you inhale. RECORD this information in the table in the <u>data section</u>.
2. Repeat Step 1 two more times. Record your trials. Calculate an average resting breathing rate.
3. **Determine your breathing rate during exercise.** Run in place for 1 minute. During this time, count the number of times you inhale. RECORD this information in the table in the <u>data section</u>.

4. Repeat Step 3 two more times. Record your trials. Calculate an average breathing rate during exercise.
5. For the last test, **choose an activity** that you can do for one minute (sit-ups, jumping jacks, jump rope, standing on one foot, dance the "twist", touching your toes, etc.). While doing the activity, count the number of times you inhale in one minute. RECORD this information in the data section.
6. Repeat Step 5 two more times. Record your trials. Calculate an average breathing rate.

Data: In the table below, record your trials and averages. Be sure to use label your data with appropriate labels and title.

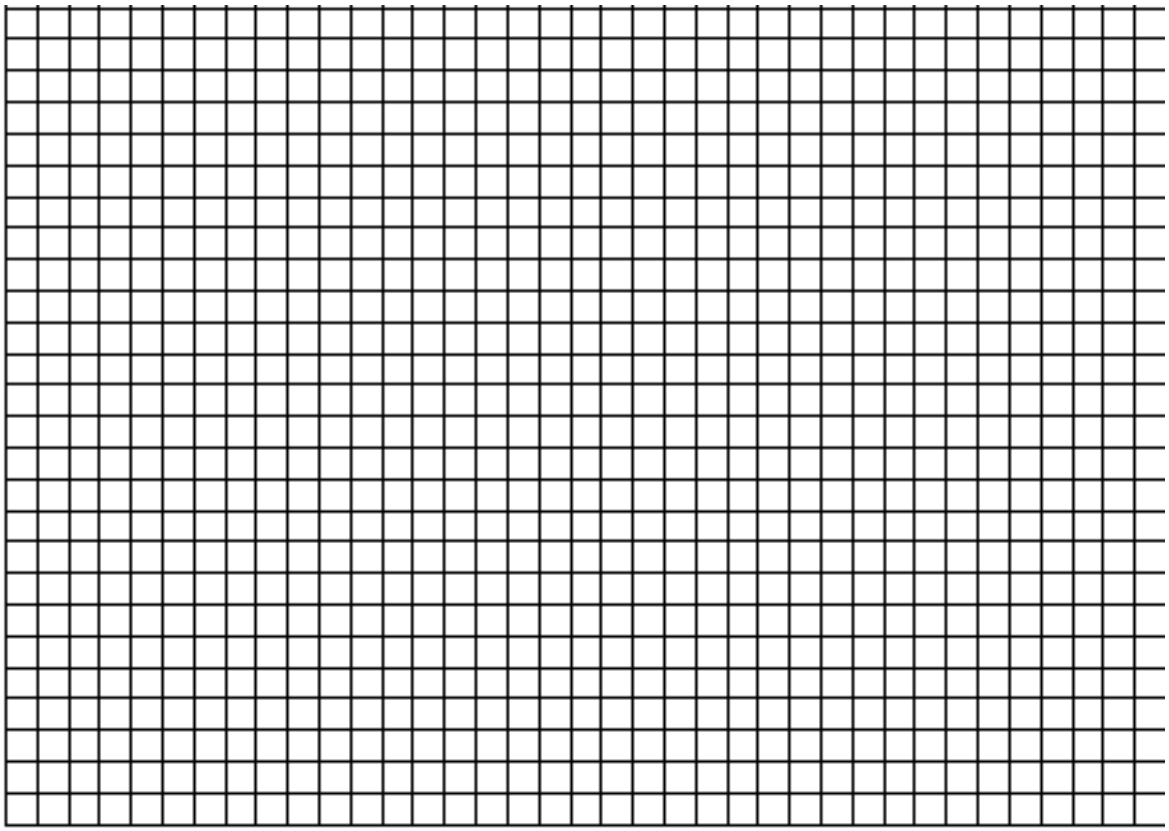
Title _____

	Sitting at Rest	Running in Place	(Record your activity here)
Trial 1			
Trial 2			
Trial 3			
Average			

Bar Graph: Create a bar graph of the **AVERAGES** from your three activities.

- Give your graph a title
- Include appropriate labels for your x and y axis
- Label your y-axis with an appropriate scale

Title _____



Analysis

1. What is the relationship between breathing rate and exercise? WHY do you think your data turned out as it did?

_____

_____

_____

_____

2. Did your data support your hypothesis? Were there any surprises? EXPLAIN!

_____

_____

_____

3. What were some controlled variables in your experiment (ie: the variables that did NOT change from trial to trial)

_____

_____

_____

4. What could you do to improve the accuracy of your data?

_____

_____

_____

5. Other than exercise, what other factors could possibly affect one's breathing rate? Explain two possible examples.

_____

_____

_____

_____

SKELETAL SYSTEM COLORING

HUMAN SKELETAL SYSTEM Color the diagram b

Number	Color	Name of Bone
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		
11.		
12.		
13.		
14.		
15.		
16.		
17.		
18.		
19.		
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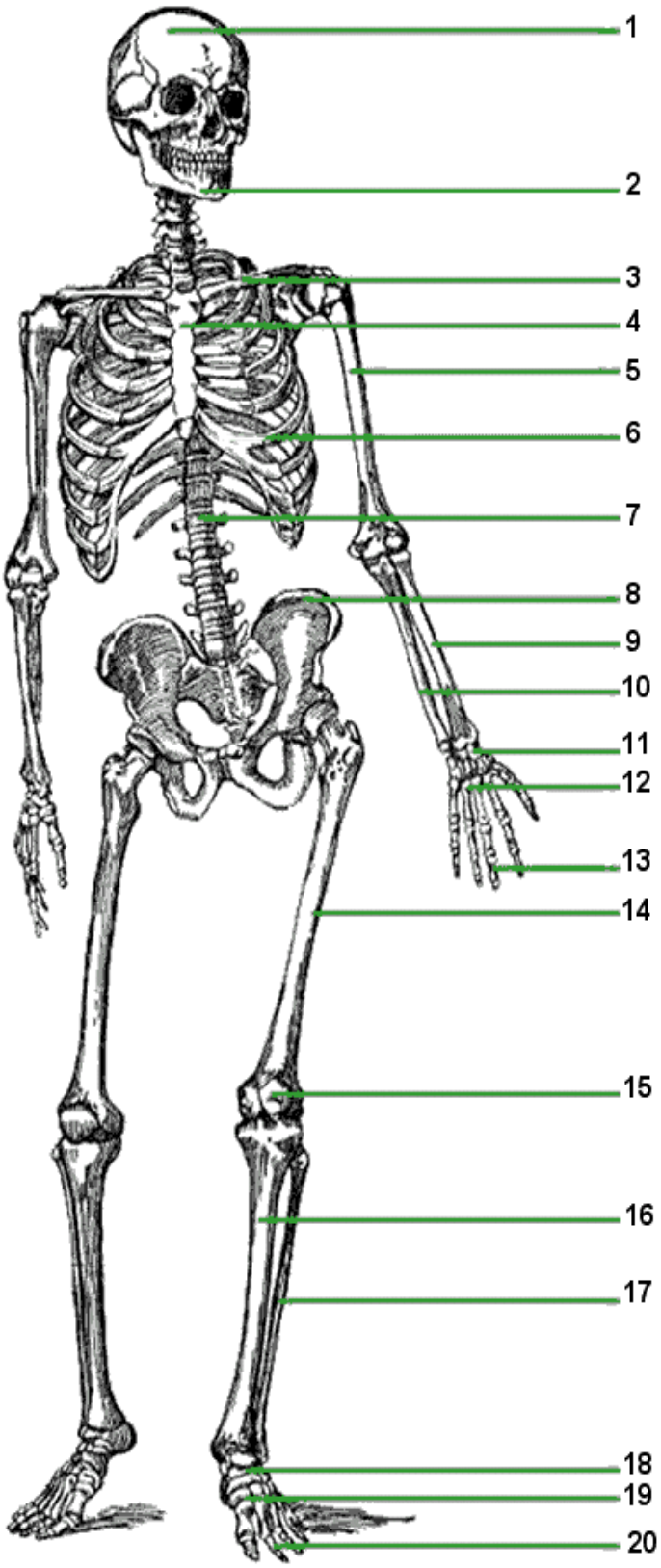

CLASSIFICATION OF BONES
There are 206 named bones of the human body that are classified into axial and appendicular skeletons

THE AXIAL SKELETON
80 bones segregated into three major regions (the skull, vertebral column, and rib cage). These are the bones that are most involved in **protecting**, **supporting**, and carrying other body parts.

The Skull: Sometimes also referred to as the **cranium**, but actually the cranium is the portion of the skull that protects the brain. The skull includes 8 cranial bones and 14 facial bones.

Mandible – the lower jaw, largest and strongest facial bone

The Vertebral Column: consists of 26 irregular bones and extends from the skull to the pelvis where it transmits the weight of the body to the lower limbs. The bones of the vertebral column include 24 vertebrae, the sacrum, and the coccyx.

The Bony Thorax: composed of the 12 pairs of **Ribs** and the **Sternum**

The Appendicular Skeleton

126 bones of the upper and lower limbs and the shoulder and pelvic girdles. These bones assist in locomotion and help us manipulate the environment.

Bones of the appendicular skeleton include:

1. **Clavicle** (collar bone: 2)
2. **Humerus** (upper arm bone: 2)
3. **Radius** (forearm, thumb side: 2)
4. **Ulna** (forearm, pinky side: 2)
5. **Carpals** (wrist bones: 16)
6. **Metacarpals** (hand bones: 10)
7. **Phalanges of hands** (fingers: 28)
8. **Pelvic Bones** (hip bones: 2)
9. **Femur** (upper leg bone: 2)
10. **Patella** (knee cap: 2)
11. **Fibula** (lower leg bone: 2)
12. **Tibia** (shin bone: 2)
13. **Tarsals** (ankle bones: 14)
14. **Metatarsals** (foot bones: 10)
15. **Phalanges of feet** (toes: 28)