HUMAN TRACES

Lesson Plan

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HUMAN TRACES

OBJECTIVE

Human Traces is a fascinating educational kit that introduces children to the anatomy of the human skeleton. The rubbing plaques contain the major bones of the body as viewed from the front. Students will be challenged to create and construct their own human skeletons by rubbing casts of bone impressions on paper. They will then be required to label the most important components of the human skeleton and participate in a variety of informative exercises.

Through participating in this activity children will (1) use deductive reasoning to create and construct their own human skeleton (2) identify many of the bones in the human body and (3) learn the basic function of these bones (4) have fun!!

MATERIALS PROVIDED

- Six plaques containing human skeletal parts
- Instructions explaining how to use the plaques
- Six high quality crayons for optimal tracing results
- Detailed information on the human skeleton
- Skeletal key with example of correct bone positioning
- Questions about the human skeleton
- Glossary
- Reproducable exercise and worksheets
- Suggested reading list

MATERIALS NEEDED

- Paper - Most papers are good for this exercise. NOTE: The size of a completed skeleton is approximately two 8½" x 11" sheets of paper taped or pasted together.

INSTRUCTIONS

In order to gain optimal learning/educational benefits from this project , Human Traces is designed to be used in one of two difficulty levels. Read over the following instructions and decide which level is appropriate for you:

LEVEL 1

1. Divide class into 6 groups.
2. Hand out one plaque and one crayon from the set to each group.
3. Give each *student* a piece of paper. .
4. Place the plaque on a table or desk.
5. Have each group choose one member to begin the exercise.
6. The first student should place paper on plaque and using the crayon, rub with firm, even strokes over the paper. The outline of the bones will appear.
7. Each student should then take his or her turn to do the same rubbing as the first student.
8. After each student has made his own rubbing, the groups should switch plaques.
9. Repeat these procedures until each group has had a chance to take a rubbing of every plaque.
10. Once the rubbings are completed, instruct students to carefully cut out each bone from their paper with a pair of scissors.

11. Instruct students to arrange the pieces on their desks so that the pieces make up the correct form of the human skeleton.
12. If students are having trouble assembling their pieces into the shape of the human skeleton, post a copy of the corresponding enclosed diagram to help them along. Note: give them sufficient time to play around with the pieces before posting the diagram.
13. You may want to instruct students to arrange their cut outs on a sheet of light colored construction paper. After the cut outs are arranged in the correct positions, paste them to the construction paper.

Instruct students to use their completed project to answer the questions and complete the exercises provided.

LEVEL 2

Tracing paper should be used at this level. This exercise is designed to be done individually. Students will need to work with all the plaques.

1. Post a copy of the enclosed diagram of the human skeleton.
2. Because the paper is translucent, when the plaques are placed underneath, the parts of the skeleton can be seen. Instruct the student to locate the skull and place it underneath and at the top of the paper. After the rubbing of the skull is completed, the student should then find the plaque containing the neck, position it beneath the skull and rub. The idea is to rub the bones on the paper in the correct positions so that no further manipulation is necessary once the final bone is in place. This method will take quite a bit more patience and dexterity than method 1. If you feel your students are not currently capable of this type of exercise, then refer to method 1.
3. Upon completion, instruct students to examine entire page. Are some of the bones out of place? If it does not look right, then have them go back to step 1 and start again.
4. Instruct them to look at their rubbings and answer the questions provided for them.

NOTE: The length of a completed skeleton may be up to 16 inches, so the paper used for the rubbings should be approximately 20" X 8½". Taping or gluing two 8½" X 11" sheets of paper together works well.

THE HUMAN SKELETON

The adult human skeleton contains about 206 bones. The skeleton is a strong framework that gives the human body support and protection. Without your skeleton, your body would be a floppy mass of flesh. Strong strap-like bands called *ligaments* hold the bones of the skeleton together at joints (where two bones come together). *Cartilage*, also present in joints, provides cushion and support. *Muscles* enable a person to move parts of his/her body. Covered in a layer of skin, *muscles* are attached to bones with *tendons* (rope-like strings at the ends of *muscles*). The human skeleton, as with many other *vertebrates* (animals with backbones), is divided into three basic sections: the skull, the torso and the limbs.

THE SKULL

The entire skull consists of 22 bones. Like the human skeleton, the skull is also divided into three basic sections: the *cranium* (the rounded part of the skull), the face and the *mandible* (the lower jaw).

The *cranium* stores and protects the brain. The *cranium* is made up of 8 bones. In a mature skull, these 8 bones are fused together in rigid (non-moving) joints called *sutures*. These *sutures* look like squiggly lines that run throughout the entire *cranium*. Unlike a mature skull, the bones in a newborn baby's head are somewhat flexible. Soft spaces between the bones allow for growth. After the head grows, the bones will fuse together, forming the *sutures*.

The 13 facial bones protect the eyes, the nose and the upper row of teeth. The *muscles* attached to these bones are responsible for moving your jaw and controlling your facial expressions such as when you smile or pout.

The 1 bone of the *mandible* is the only movable portion of the entire skull. It contains the lower row of teeth and assists in chewing.

Connecting the head and *torso* (center of body)) is the upper portion of the backbone known as the neck. The neck consists of seven vertebrae (small bones which make up the spine). The neck supports the skull and contributes to head movement.

THE TORSO

The bones of the *torso* can be divided into four basic sections: the *pectoral girdle* (shoulder area), the spine (back bone), the *rib cage* and the *pelvic girdle* (hip area).

The *pectoral girdle* (shoulders) consists of 2 *clavicle* (collar bone) and 2 *scapula* (shoulder blades) . This is where the arms attach to the *torso.*

The spine, consisting of 26 bones called *vertebrae*, enables the human body to stand upright, bend and turn. Each vertebra is designed to provide support and flexibility for the back and to protect the *spinal cord*. The *spinal cord* runs through a protective hole in the middle of each vertebra.

The *rib cage* is a flexible "bone box" that protects the heart and lungs. Comprised of 12 rib pairs, the *rib cage* connects to the spine in the back. In the front, the top 7 pair of ribs are directly attached to the *sternum* (breast bone) by cartilage, these ribs are called the *true ribs*. The next two pair of ribs are joined in the front, to the ribs above, by cartilage, they are called the *floating ribs*. The 2 lowest pair of ribs are not connected to the *sternum* at all and are called *false ribs.* The flat, resilient (springy) bones of the *rib cage*, along with their corresponding *muscles*, provide flexible protection for vital organs and expansion capabilities for breathing lungs. When breathing in, *muscles* lift the ribs upward and swing them outward, increasing the volume of the chest and sucking air into the chest.

The *pelvis* (hip bone) consists of two, wide, bowl shaped bones which supports and protects the reproductive, urinary and digestive organs. Broad *muscles* are attached to the front and rear of these large bone, extending down each leg to provide the mechanism with which to move. The *pelvis* also contains two hip joints. Each joint consists of a socket where the round (ball) at the top of each thigh bone fits. These joints connect the *torso* to the legs.

ARMS

Each human arm is made up of three bones: the *humerus*, the *radius* and the *ulna*.

The *humerus* (bone in upper arm) fits into the socket of the shoulder joint. This type of joint is known as a *ball and socket joint* and is designed to provide full range of motion and stability to each of the arms. This durable joint, along with the accompanying *muscles* and *ligaments*, allows for heavy lifting with the arms.

The *humerus* is connected to the *radius* and *ulna* (forearm) at the *elbow* (a hinged joint). Much like a typical door hinge, the hinge joint does not move beyond a 180 degree angle.

The *radius* and *ulna* bones run side by side from the *elbow* to the wrist (the joint of the hand). The radius is on the inside of the arm and is the longer of the two bones (located on the thumb side of the arm). The ulna is on the outside of the arm.

The hand is made up of the *carpals* (wrist bones), the *metacarpals* (palm) and the *phalanges* (fingers). Along with a complex set of *ligaments*, *tendons* and *muscles*, the arm and hand bones are designed to work as a series of levers that can move in almost any direction.

LEGS

Like the arms, each human leg is basically made up of three bones: the *femur*, the *fibula* and the *tibia*.

The *femur* (upper leg) is the long bone that is connected to *pelvis* with the *ball and socket joint* (hip joint). *Femur*s are the largest bones in the body.

The *femur* is connected to the *fibula* and *tibia* (lower leg) at the knee joint. The *patella* (knee cap) is a small bone that covers and protects the joint of the knee.

The *fibula* and *tibia* bones (lower leg) run side by side from the knee to the *ankle* (the joint of the foot). The tibia is the largest of the two bones and is located toward the inside of the leg. The fibula is located toward the outside of the leg.

The foot is made up of the *tarsals* (*ankle* bones), the *metatarsals* (heel and ball of foot) and the *phalanges* (toes). These bones, along with a complex web of *ligaments*, *tendons* and *muscles*, withstand the intense weight and pressure created by walking, running and jumping.

EXERCISES

1. Manipulate your bone rubbings so that your skeleton is in an upright, standing position with its arms hanging down by its sides.

2. Match the scientific names with bones with their more common names:

Carpals	*Ankle* Bones
Clavicle	Breast Bone
Coccyx	Collar Bone
Cranium	Finger & Toe Bones
Femur	Foot Bones
Humerus	Forearm
Mandible	Head
Metacarpals	Hip Bone
Metatarsals	Jaw Bone
Patella	Knee Cap
Pelvis	Palm Bones
Phalanges	Shin Bone
Scapula	Shoulder Blade
Sternum	Spine
Tarsals	Tail Bone
Tibia	Thigh Bone
Ulna & *Radius*	Upper Arm
Vertebrae	Wrist Bones

Using this chart, label the parts of your skeleton with the correct scientific names.

2. Draw an outline around your skeleton as if the bones had muscle and skin attached.
3. Manipulate your bone rubbings so that your skeleton is in a walking position.

QUESTIONS

After reading about the human skeleton, answer these questions;

1. The adult human skeleton contains how many bones?
2. What is a joint? Can you name two types?
3. What is the purpose of the skeleton?
4. Why do we need *muscles*?
5. How many bones are in the human skull?
6. What are *sutures*?
7. Name the only moveable bone in the skull.
8. What are *vertebrae*? How many do we have?
9. What is the “bone box”?
10. What is a *pelvic girdle*?
11. Where in the skeleton can we find a joint known as a ball and socket?
12. Which bone is the largest bones in the body?
13. What is a *patella*?
14. How many *phalanges* do we have?
15. Name some of the bones in the *torso*.
16. Name the bones in the arms.
17. Name the bones in the legs.
18. Are there any similarities between the arms and legs?
19. What does the *torso* have to do to the arms and legs?

GLOSSARY

ankle - the joint between the lower leg and foot, the largest bone of the ankle is the tarsus

ball and socket joint - a joint that allows movement in many directions, i.e. the shoulders, hips and thumb joints

carpals - bones of the wrist

cartilage - a very tough material which acts as a cushion between two bones

clavicle - the two bones between the sternum and the shoulders, collar bone

cranium - the rounded, top part of the skull

elbow - the hinged joint in the arm, between the upper and lower arm

false ribs - the tenth to the twelfth pair of ribs , they are not attached at the front

femur - the thigh bone, the largest bone in the body

fibula - the outer bone in the leg below the knee

floating ribs - the eighth to the tenth pair of ribs, joined to the ribs above at the front

humerus - the bone in the upper arm

ligaments - tough, rope-like material that holds the bones of a joint together

mandible - the strong, curved bone which forms the lower jaw

metacarpals - bones of the hand, the bones between the wrist and the fingers

metatarsals - bones of the foot, between the ankle and the toes

muscles - tissue mass which have the property of contracting and relaxing and which produce motion

patella - the bone protecting the knee, knee cap

pectoral girdle - portion of the skeleton which provides support and attachment for the arms

pelvic girdle - portion of the skeleton to which the legs are attached

pelvis - the hip bones

phalanges - the bones of the fingers and toes

radius - the smaller bone of the forearm, the bone on the same side of the arm as the thumb

rib cage -the area formed by the twelve pairs of ribs

scapula - the bones of the shoulders

spinal cord -large bundle of nerve tissue running down from the brain, protected by the spine

spine - the jointed back bones or vertebrae, bones protecting the spinal cord

sternum - the breast bone to which most of the ribs are attached

sutures - an unmovable joint such as between adjacent flat bones of the skull

tarsals - bones of the ankle

tendons - tough rope-like tissue which connect a muscle to a bone

tibia - the at the front of the lower leg, shin bone

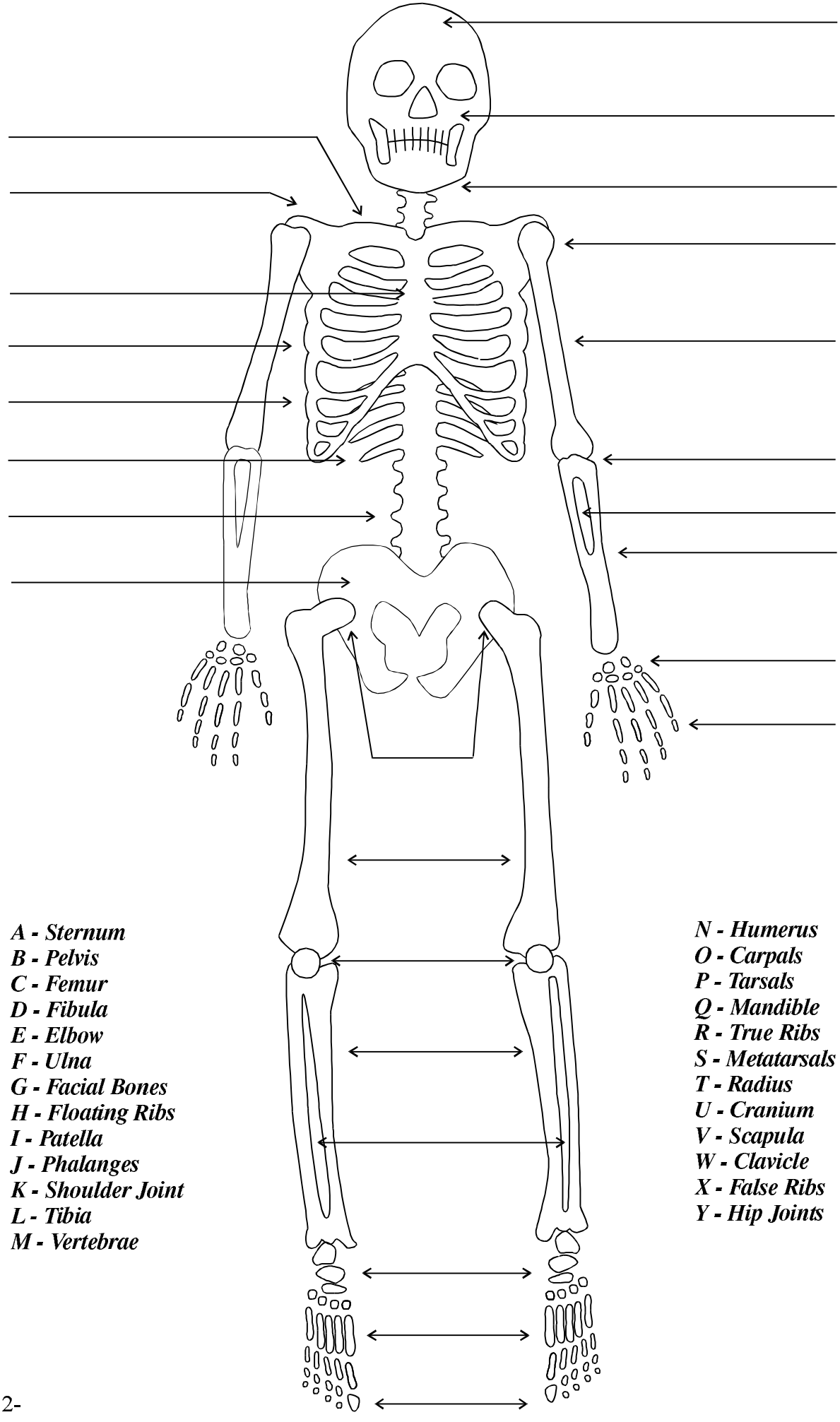
torso - the center portion of the body between the head and the limbs

true ribs - the first to the seventh pair of ribs which are attached directly to the breast bone by cartilage

ulna - the largest bone in the forearm, on the same side of the arm as the smallest finger

vertebrae - the small bones in the back, joined together to make up the back bone or spine

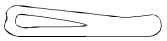
vertebrates - all living organisms with a vertebra or backbone



A - Sternum
B - Pelvis
C - Femur
D - Fibula
E - Elbow
F - Ulna
G - Facial Bones
H - Floating Ribs
I - Patella
J - Phalanges
K - Shoulder Joint
L - Tibia
M - Vertebrae

N - Humerus
O - Carpals
P - Tarsals
Q - Mandible
R - True Ribs
S - Metatarsals
T - Radius
U - Cranium
V - Scapula
W - Clavicle
X - False Ribs
Y - Hip Joints

Exercise Sheet

	Bone Group	Names		Bone Group	Names
A			G		
B			H		
C			I		
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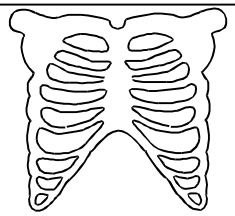
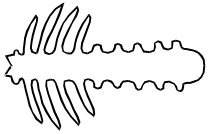
E			K		
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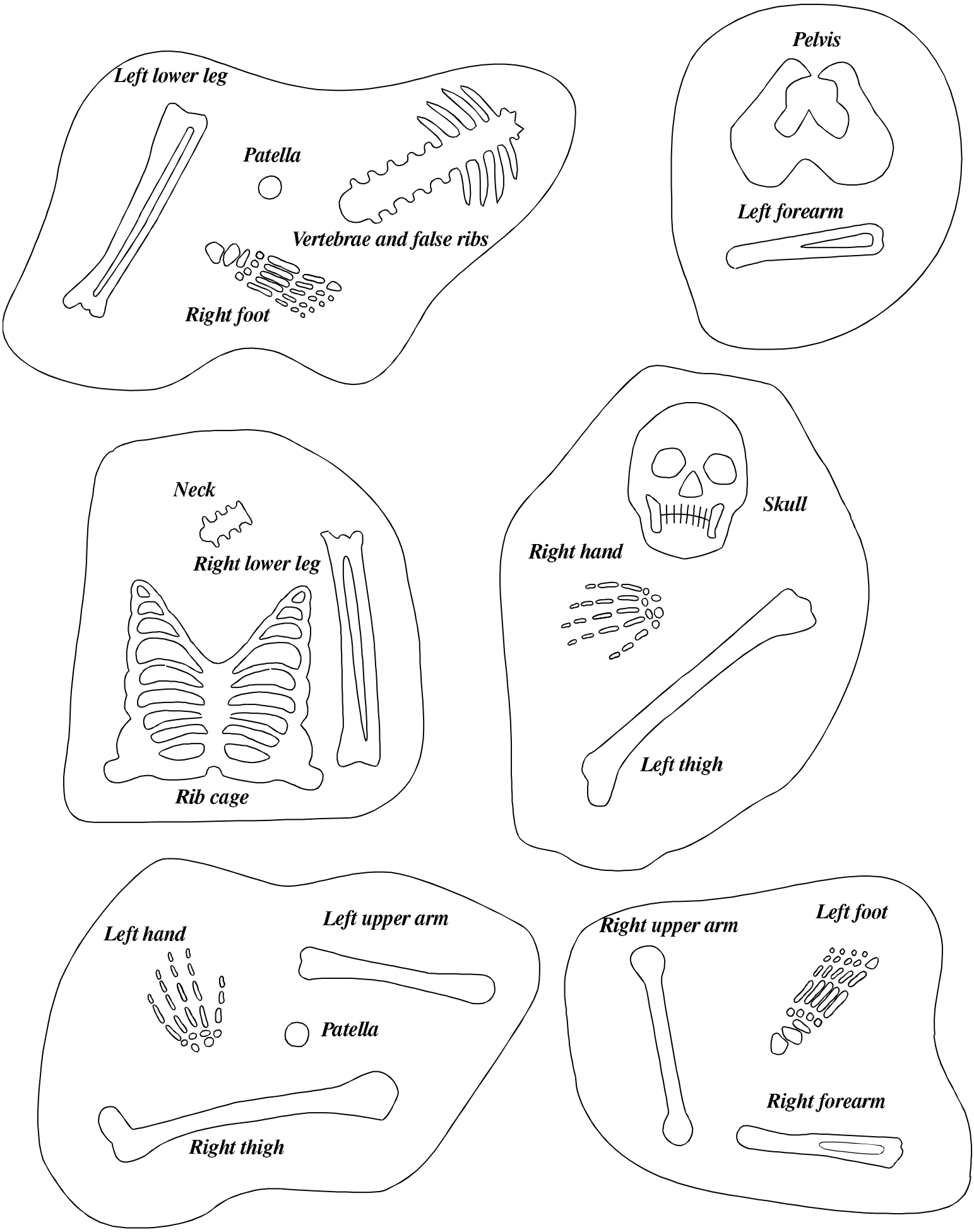

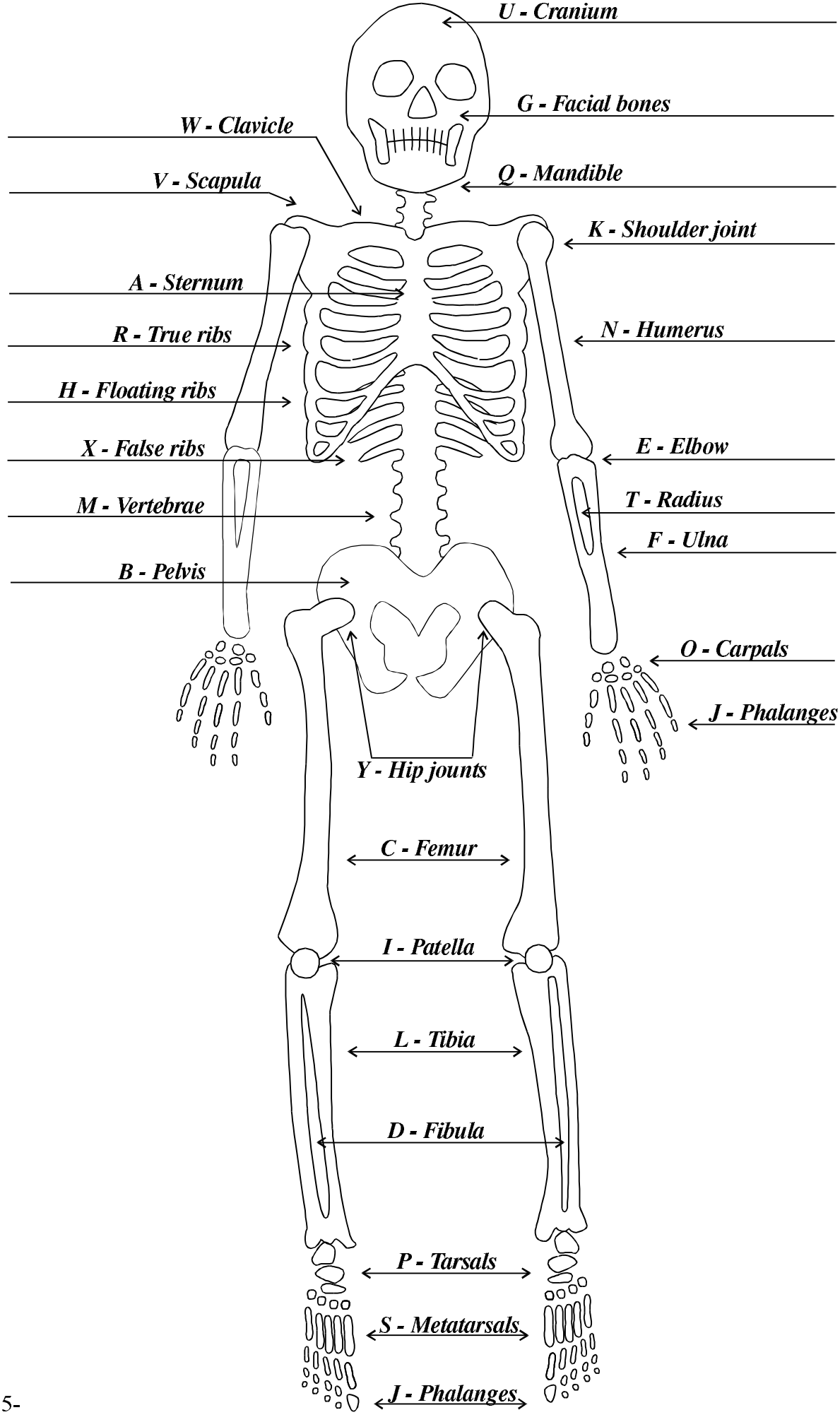
U - Cranium
G - Facial bones
W - Clavicle
V - Scapula
Q - Mandible
K - Shoulder joint
A - Sternum
R - True ribs
N - Humerus
H - Floating ribs
X - False ribs
E - Elbow
M - Vertebrae
T - Radius
F - Ulna
B - Pelvis
O - Carpals
J - Phalanges
Y - Hip jounts
C - Femur
I - Patella
L - Tibia
D - Fibula
P - Tarsals
S - Metatarsals
J - Phalanges

vertebrates - all living organisms with a vertebra or backbone

SUGGESTED READING LIST

Alexander, R. McNeill, (1992) The Human Machine. Columbia University Press: New York, NY.

Bruun, Ruth & Bertel, (1982) *The Human Body*. Random House: New York, NY.

Parker, Steve, (1989) *The Skeleton and Movement*. Franklin Watts: New York, NY.

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