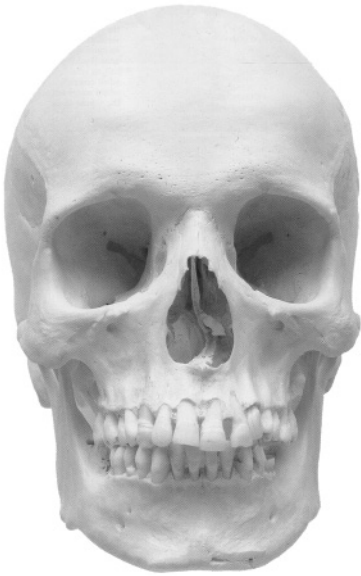


HUMANWORKS



Discover the incredible workings of human anatomy – cast, finish, assemble & display an entire human skeleton!



HUMAN SKELETON

HUMANWORKSTM

★ Read directions thoroughly before starting. ★

Humanworks is a fun-filled educational kit that is a perfect introduction to the anatomy of the human skeleton. Did you know that there are 22 bones in the human skull? Learn to recognize and name the major bones of the body. Cast, finish, and assemble an entire skeleton. Display it on your refrigerator with the supplied magnets or glue the skeleton to a surface of your choice.

MATERIALS PROVIDED

- Information about the workings of the human skeleton.
- Casting (PerfectCast) material for one complete skeleton. To make more human skeletons, additional PerfectCast is available from your local retailer.
- 2 mold trays containing a complete human skeleton.
- Instructions on how to use the mold trays.
- Reference diagram to consult while constructing the human skeleton.
- Magnets and glue to attach the skeleton pieces. A guide for attaching magnets to skeleton.
- Paint and paint brush to finish the skeleton.
- Glossary.
- Bibliography.

MATERIALS NEEDED

- Disposable container to mix PerfectCast. A can or paper cup will work nicely.

WARNING: Don't place hand in casting material while it is hardening. Don't pour excess material into drain or toilet bowl. Dispose of excess material in garbage.

★ Adult supervision suggested ★

INSTRUCTIONS

Find an area with a flat, level, stable working surface, such as a counter-top, desktop or table. Make sure the surface is waterproof; some excess water may spill out of your container. Use a disposable container to mix the PerfectCast and water.

1. Place the mold tray on a flat, stable surface.
2. In a disposable container, mix PerfectCast using a ratio (by volume) of 1 part cold water to 3 parts PerfectCast. *See tip below for suggestion on estimating the amount of PerfectCast to use for your cast.*
3. Stir the PerfectCast/water mixture with a spoon or mixing stick until it is evenly mixed (about 1½ minutes). Tap the container on the table several times to remove air bubbles. There should be no lumps.
4. Pour the PerfectCast mixture into the mold. Tap the mold on the work surface to remove the remaining bubbles.

WARNING: Do not pour excess material into the drain or toilet bowl. Dispose of excess materials in the garbage.

5. Let PerfectCast set for 30 to 40 minutes. If the object is delicate, allow at least one hour before demolding.
6. After the mixture hardens, carefully press each part out of the mold. If a section should break, use glue to repair it or cast additional sections.
7. Read the information which explains the workings of human skeleton.
8. Let casts dry for 2 hours before painting. Separate the paint pots from each other with sissors before painting. Experiment with mixing paints on a palette or other surface to create the desirable colors. Adding a small amount of water to the paint will thin it for easier application as well as insure enough volume to cover the complete item.
9. Using the guide on page 7, glue the magnets on skeleton sections or glue the sections on a background of your choice.
10. Consult the diagram of the completed skeleton and arrange pieces accordingly.

Tip: How to measure the volume of the objects to be cast.

If you have purchased additional PerfectCast or don't want to mix all the PerfectCast included in your kit, follow the instructions below to determine how much PerfectCast to mix.

Fill all the cavities you intend to cast with water and pour into a measuring cup. This is the total volume of the finished casts.

For each fluid ounce needed, mix 1½ fluid ounces of PerfectCast and ½ fluid ounce of water. The mixture should have a consistency like a milkshake.

THE HUMAN SKELETON

The Skull

The entire skull consists of 22 bones, three basic sections: the cranium (the rounded part of the skull), the face, and the mandible (the lower jaw). The cranium protects the brain. It 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 mandible bone 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.

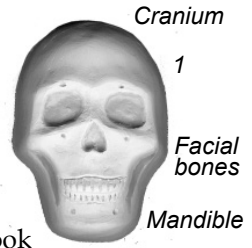
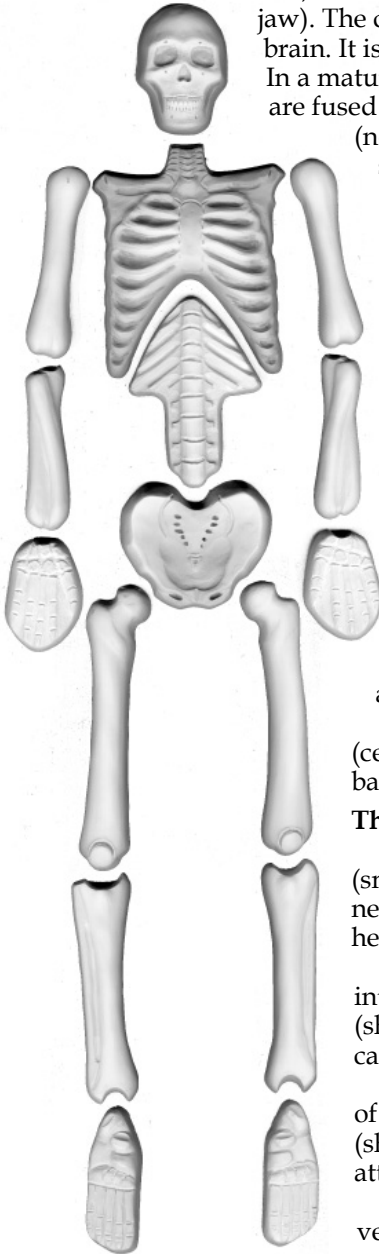
The Neck and torso

The neck consists of seven vertebrae (small bones which make up the spine). The neck supports the skull and contributes to head movement.

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

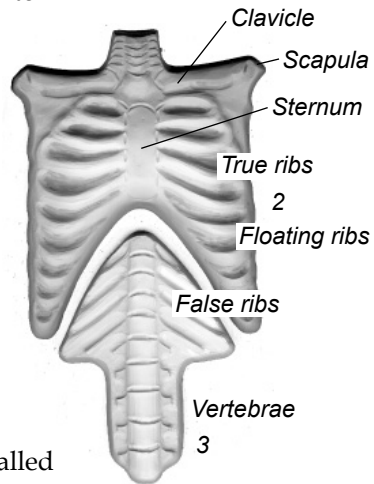
The pectoral girdle (shoulders) consists of 2 clavicles (collar bone) and 2 scapulas (shoulder blades). This is where the arms attach to the torso.

The spine, consisting of 26 bones called vertebrae, enables the human body to stand upright, bend, and turn. Each vertebra



is designed to protect the spinal cord and to provide support and flexibility for the back. 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.

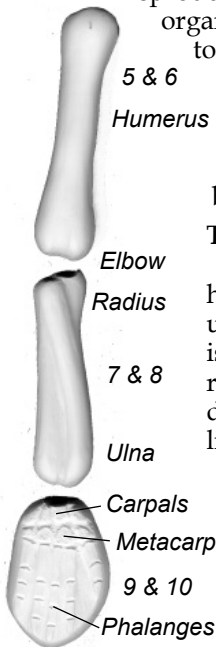
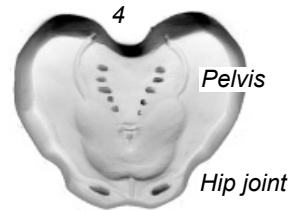
Comprised of 12 rib pairs, the rib cage connects to the spine in the back. In the front, the top 7 pairs of ribs are directly attached to the sternum (breast bone) by cartilage. These ribs are called the true ribs. The next two pairs of ribs are joined in the front, to the ribs above, by cartilage. They are called the floating ribs. The two lowest pairs 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 room for the lungs to expand as you breathe. 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

The pelvis (hip bone) consists of two wide, bowl shaped-bones that support and protect the reproductive, urinary, and digestive organs. Broad muscles are attached to the front and rear of this 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.



The arm

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 is 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

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 made up of three bones: the femur, the fibula, and the tibia.

The femur (upper leg) is the long bone that is connected to the pelvis with a ball and socket joint at the hip. Femurs 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.

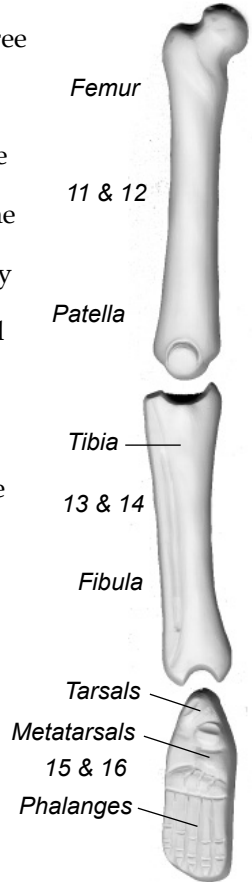
The ankle and foot

The ankle 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.

Cutting guide for magnets

IMPORTANT NOTE:

The non-grooved side of the magnet is the side that is most strongly attracted to metal. Magnets should be cut lengthwise down the middle and then into one- inch pieces. The following chart indicates the number of 1" magnets. Remember to glue the grooved side of the magnet (when in doubt test on metal) to the individual sections of the skeleton. The numbers relate to the skeleton sections.



	Description	Magnets
1	Head	1
2	Chest	4
3	Back bone	2
4	Pelvis	2
5	Humerus	1
6	Humerus	1
7	Radius & ulna	1
8	Radius & ulna	1

9	Carpals & phalanges	1
10	Carpals & phalanges	1
11	Femur	2
12	Femur	2
13	Tibia & fibula	1½
14	Tibia & fibula	1½
15	Tarsals & phalanges	1
16	Tarsals & phalanges	1

GLOSSARY

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

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 tough material that acts as a cushion between two bones

clavicle - the two bones between the sternum and the shoulders

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 pairs of ribs which 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 pairs of ribs, joined to the ribs above at the front

humerus - the bone in the upper arm

ligament - tough, rope-like material that holds bones together at a joint

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

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

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

muscle - tissue mass that has the property of contracting and relaxing and which produces motion

patella - the bone protecting the knee

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, 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

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

tarsals - bones of the ankle

tendon - tough rope-like tissue that connects a muscle to a bone

tibia - the bone at the front of the lower leg
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 backbone or spine
vertebrates - all living organisms with vertebrae or a backbone

BIBLIOGRAPHY

Alexander, R. McNeill (1992), *The Human Machine*, Columbia University Press, New York
Bruun, Ruth & Bertel (1982), *The Human Body*, Random House, New York
Parker, Steve (1988), *Eyewitness Skeleton*, Alfred A. Knopf, Inc., New York
Parker, Steve (1989), *The Skeleton and Movement*, Franklin Watts, New York

COLOR MIXING GUIDE

Kits come with different sets of colors depending on the title of the kit. Mixing instructions may include colors not included in your kit.

Acrylic paints can be thinned with water if they get too thick. Be sure to clean brushes with soap and water before the paint hardens or the paint will become permanent.

Primary colors can be mixed to obtain many other colors. Mix a small amount of two or more colors on a non-absorbent surface.

Always begin with more of the lighter color and a small amount of the darker color. To darken or lighten colors, add small amounts of black, brown or white and mix. Take your time and allow the paint to mix thoroughly before adding more paint.

- White skin - add small amounts of red and yellow to white
- Black/brown skin - add small amounts of white, yellow, red & black
- Army green - mix blue and yellow and a small amount of black
- Ammonite green - mix blue and yellow and a small amount of white
- Carmel - mix small amounts of brown and yellow to white
- Tan or beige - add small amounts of red, brown and yellow to white
- Brown - mix black, yellow, red and green
- Orange - add small amounts of red with yellow
- Gray - mix small amounts of black with white
- Pink - mix small amounts of red with white
- Purple - mix red and blue
- Gold - mix small amounts of yellow with silver
- The pot labeled GL is glue
- Some kits come with a pot labeled ST. This is stain that can be used to antique your creation after painting. Paint on and wipe off.

Download other Kit brochures at: <http://skullduggery.com>

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