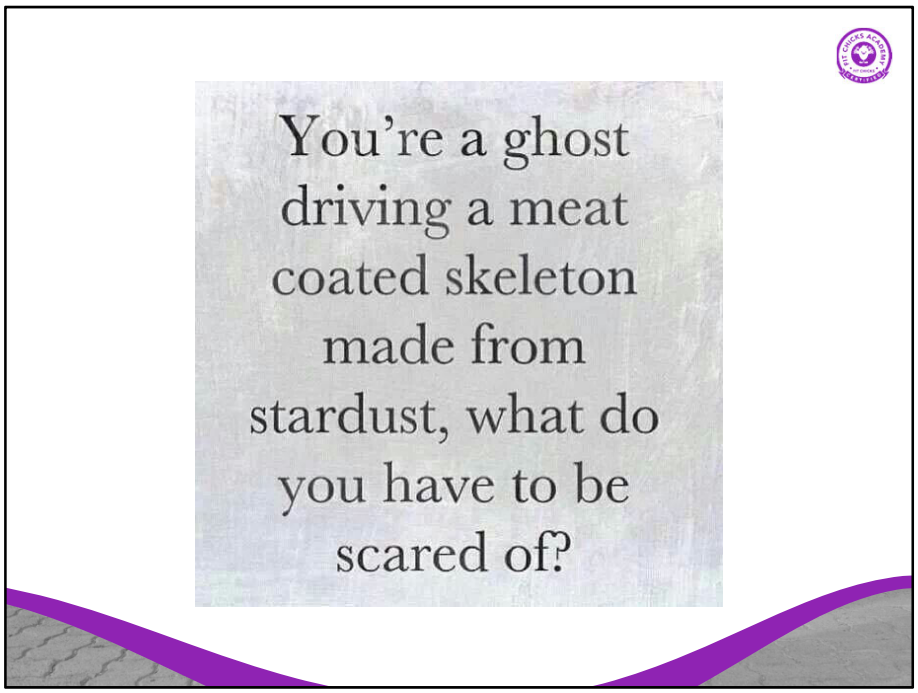
FITNESS & NUTRITION EXPERT PROGRAM

FITNESS SESSION 3:

Skeletal Anatomy &Flexibility


You're a ghost driving a meat coated skeleton made from stardust, what do you have to be scared of?

What we are going to cover

INTRODUCTION TO THE FITT PRINCIPLE

- What is the FITT principle and how to apply it

SKELETAL ANATOMY

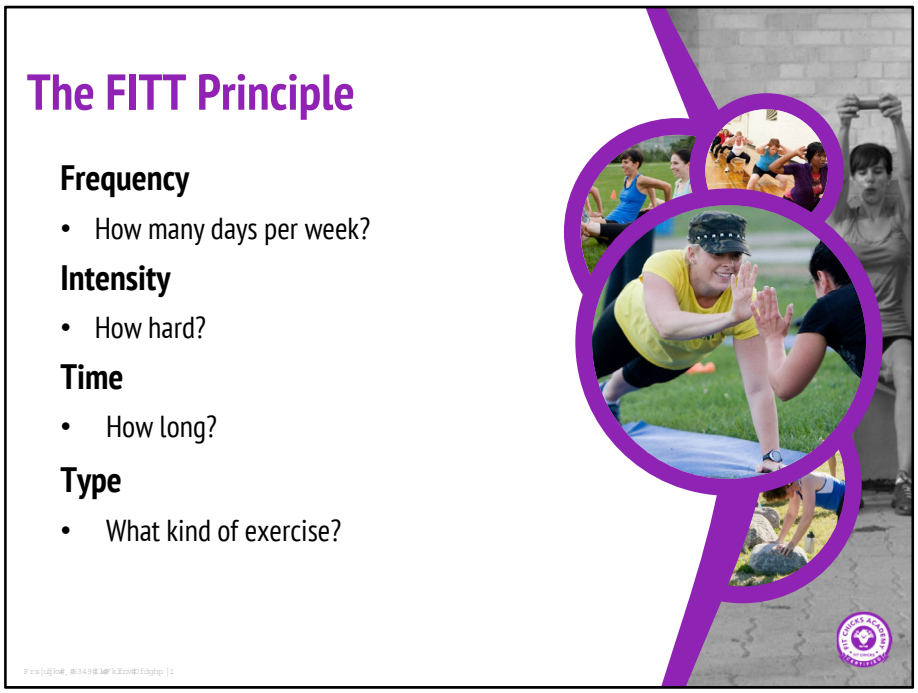
- Facts and components of the skeleton
- Primary functions and structure of the skeleton
- Learning the major bones in the skeleton
- Identification, Classification, and Markings of bones and joints
- How Exercise affects bones and joints
- Anatomical position and terminology
- Planes of movement and joint movement terminology

FLEXIBILITY

- What is Flexibility
- Benefits of Flexibility Training
- Assessing Flexibility
- Designing a Flexibility Training Program

What you need before we start

1. Water
2. Put your finger tips together
3. Take 3 deep breaths



When you are designing a program, these are the things you want think about.

Frequency: How often will I do this?
Intensity: How hard will it be?
Time: How long will I do it for? How long is each session, how long is overall program.
Type: What am I going to do?

The FITT Principle - Example

For a runner with a 5km goal

Frequency

- 3 days a week

Intensity

- Slow and steady

Time

- 5 mins to start

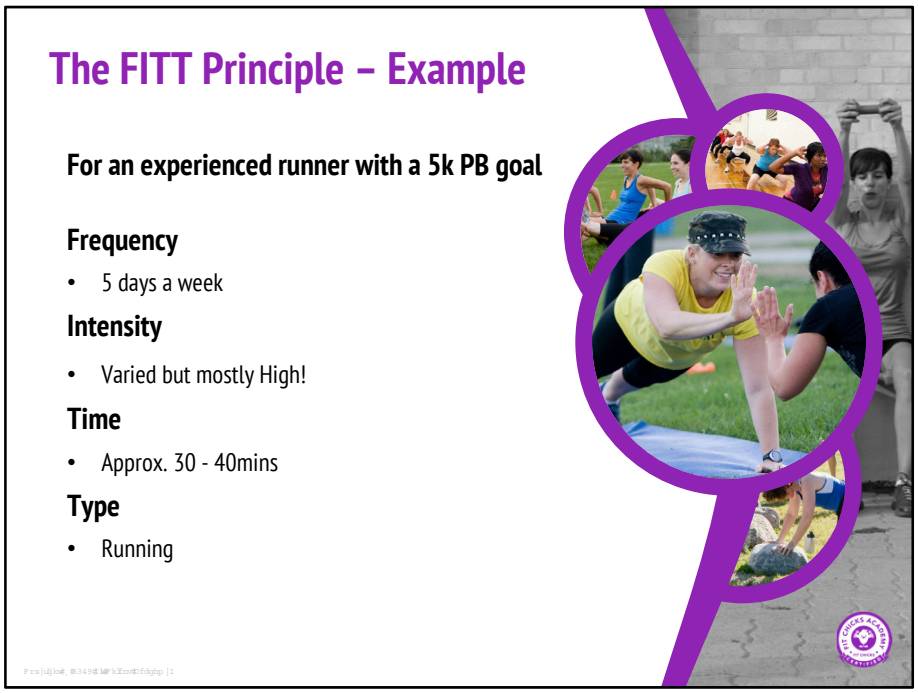
Type

- Running

This is a super simplistic example of applying fitt.
Whenever we design a program for someone, we run through these variables.
If we want to progressively overload their program (make it harder), we think, “am I going to make them do it more frequently, more intensely, for longer, or make them do something else?

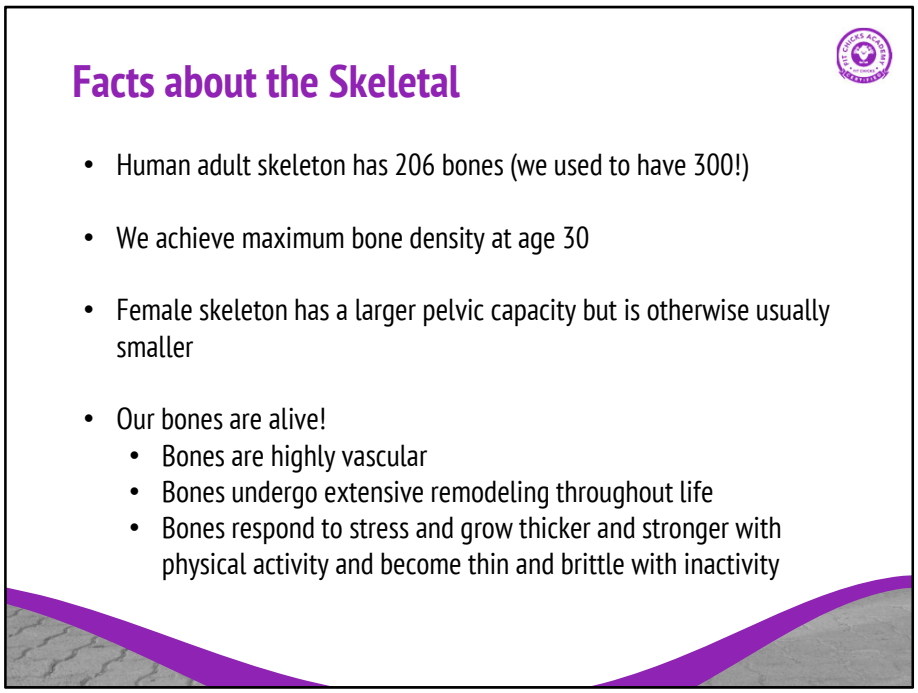
The FITT Principle - Example

For an experienced runner (she's been running 3-5 x a week for 1 year) who wants to get a Personal Best on a 5K this spring.



In this example you have a runner that's already used to high volume so their body can handle an increase in intensity. The increase in intensity is what will push their body to a faster time. You don't necessarily want all their runs being at a high intensity but a few keys runs should be. You should also have a run that's a little longer than their average 5km, maybe have them do a 6k so on race day a 5km seems that much more doable.

PB = personal best

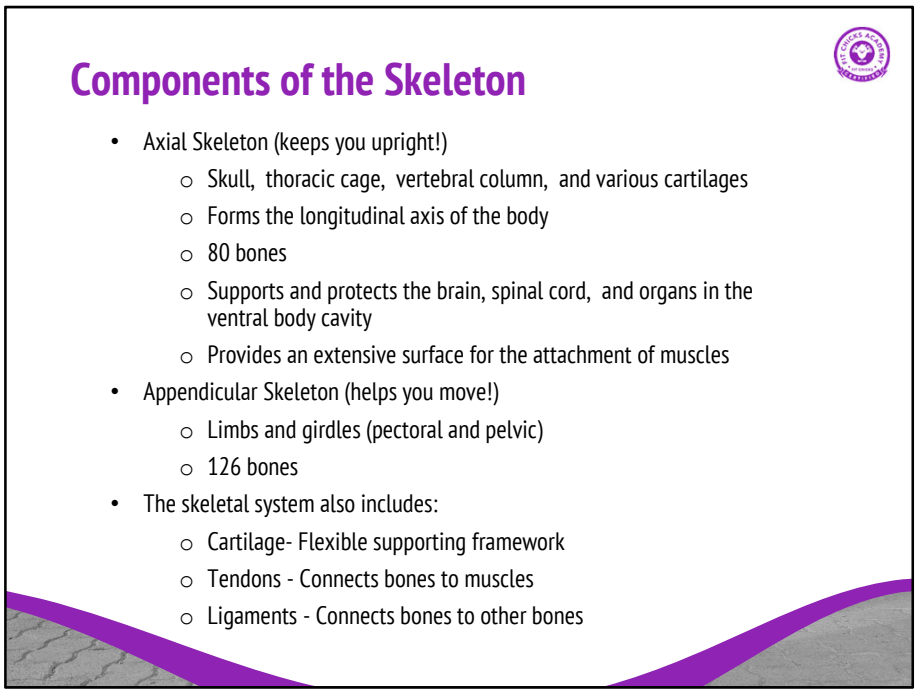


At birth, you have about 270-300 bones. As you grow older, small bones join together to make big ones (think of your skull)

Adults end up with about 206 bones. But we don't end up with our final amount of bones until age 20-25

We achieve maximum bone density by age 30, after which our bones get more brittle. Exercise helps maintain the strength of our bones.

- Men's bones are usually larger and heavier than females
- Bones are alive, that is why they can grow and repair themselves when broken

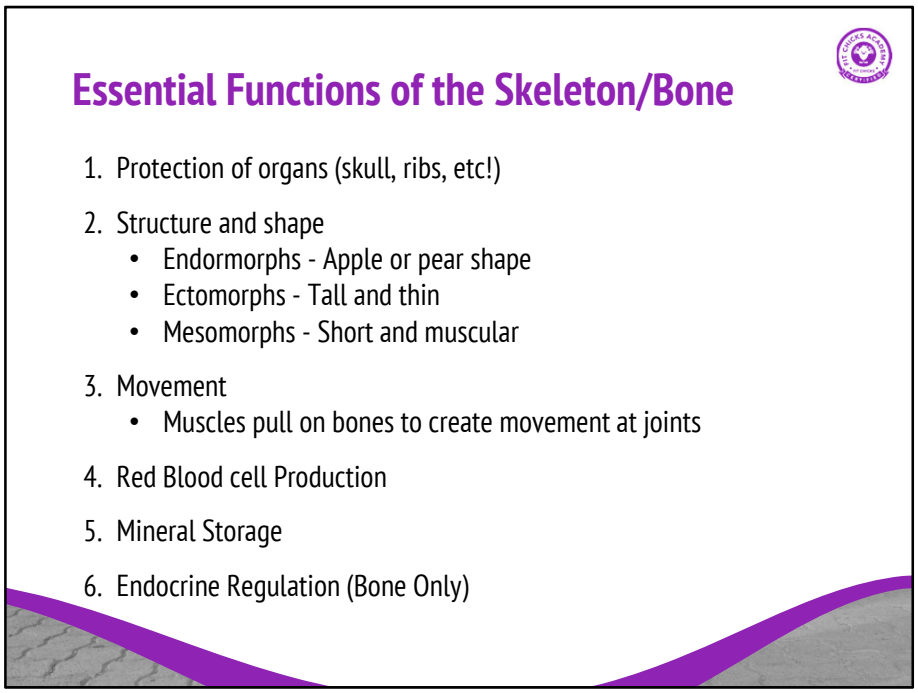


The axial skeleton makes up our central axis and consists of the following bones: skull, vertebrae, ribs and sternum.

The appendicular skeleton consists of the limbs and girdles. The girdles are the attachment points for the limbs. The pelvic girdle is the attachment point for our thigh bone (femur) and consists of an individual os coxae (ilium, icshium, pubis). The pectoral girdle is formed by the clavicle and scapula and serves as the attachment point for our arms (humerus).

There are three types of cartilage
1. Hyaline: - provides stiff but flexible support and reduces friction btw boney surfaces
- found between the ribs and the sternum, covers the surfaces at mobile joints, supports the respiratory passageways, forms part of the nasal septum
2. Elastic: - can be bent and twisted without damage and will return to its normal shape
- supports the external ear and a number of internal structures
3. Fibrocartilage: - resists compression, prevents bone-to-bone contact, and limit relative movement
- the meniscus, between the bones at the pubic symphysis, in the

intervertebral discs



Protection

The axial skeleton, consisting of the skull, thorax and vertebral column, is the primary division of the skeleton responsible for protecting vital organs. The skull protects the brain and the vertebral column protects the spinal cord, both vital organs within the nervous system. The sternum and rib cage work together to protect the heart and lungs. The pelvis (part of the appendicular skeleton) cradles the digestive and reproductive organs.

Support

The skeletal system provides structure and support for the entire body. The skeleton also provides a framework for all other soft tissues (muscle and organs) to attach to.

Locomotion

Interaction between the muscular system and the skeletal system allows the bones in the body to move. Muscles are connected to bone by tendons,

Production of Red Blood Cells

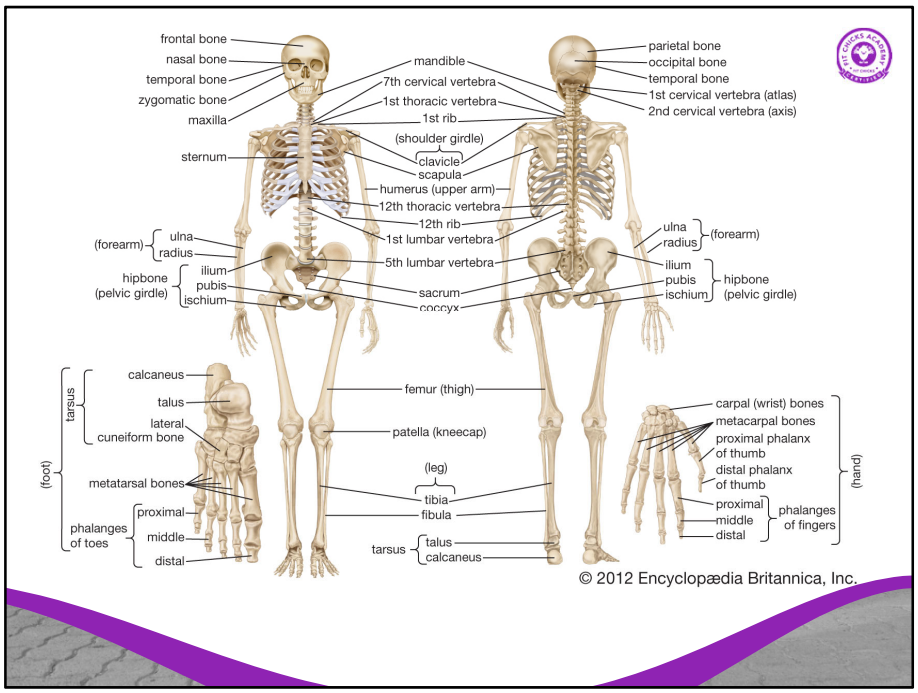
Bone marrow that is located in certain bone structures (flat bones and at then ends of long bones) produces red blood cells for the body.
Red blood cells survive on average 120 days
Healthy marrow produces, on average, 2.6 million red blood cells per second.

Mineral Storage

Bones store important minerals such as calcium and phosphorous for the body. When the amount of one of these minerals in the blood is too high, it will be stored in the bones. To the contrary, when blood levels of the minerals get too low they are transferred out of the bones back into the blood.

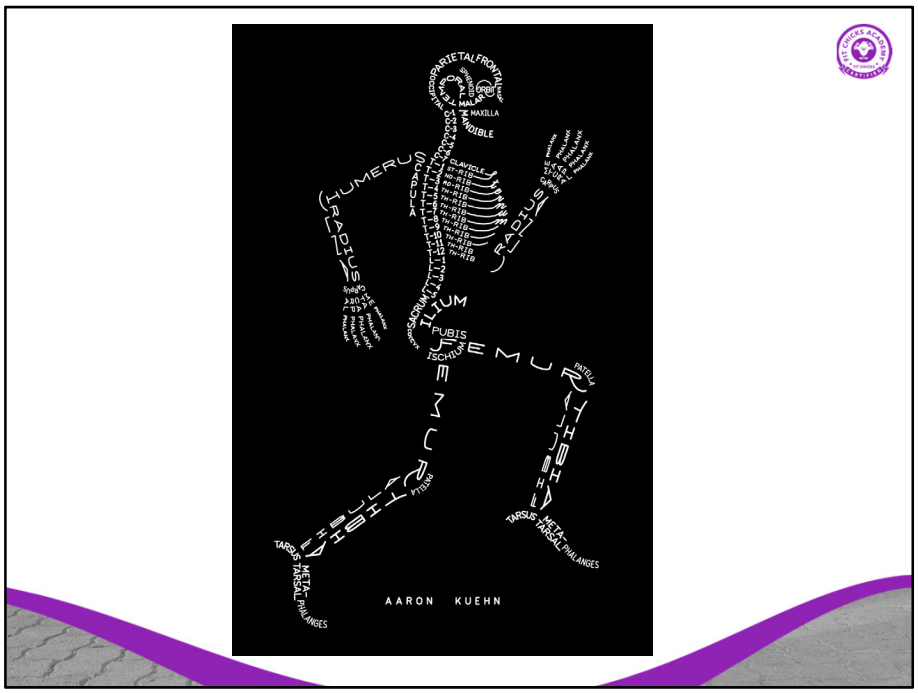
Endocrine Regulation

- Bone also plays a role in energy metabolism and glucose homeostasis
- https://www.the-scientist.com/daily-news/endocrine-role-for-skeleton-46225

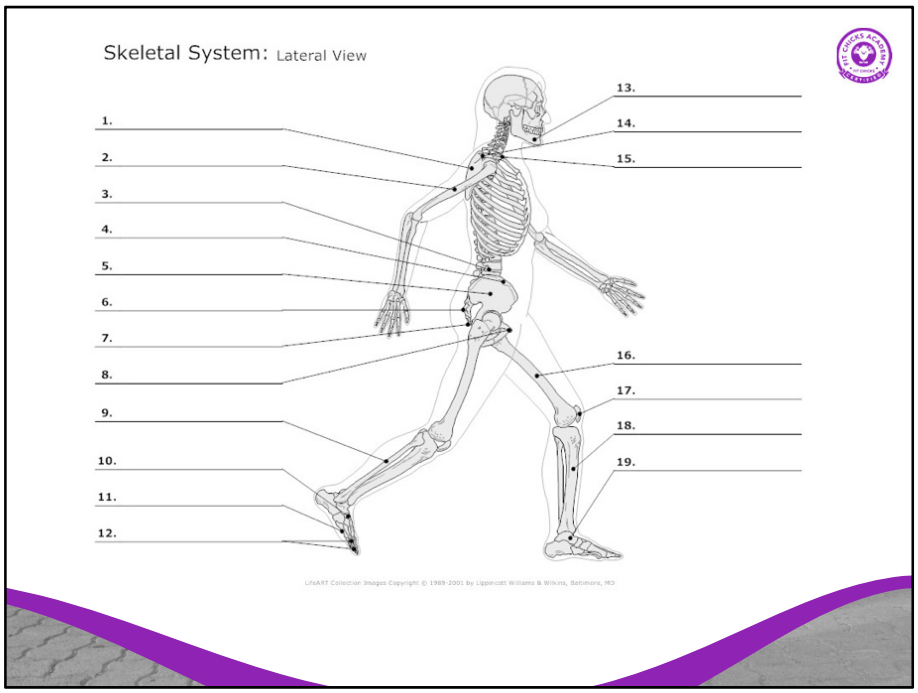


-Go through bones and mention the 'layman's terms for the different ones

- 'clavicle' = 'collar bone'
- Scapula = shoulder blade
- mandible = jaw
- Sternum = breast bone
- Olecranon process of the humerus = funny bone
- Ilium = hip bone
- Ishium = sit bones
- Pubis = pubic bone
- Phalanges = fingers and toes



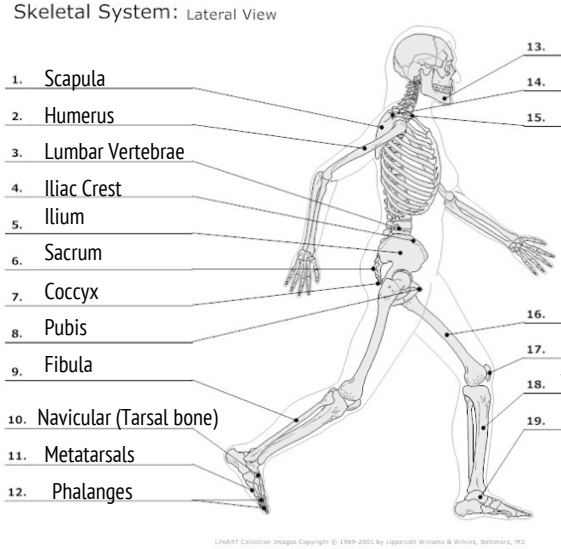
https://aaronkuehn.com/art/skeleton-typogram



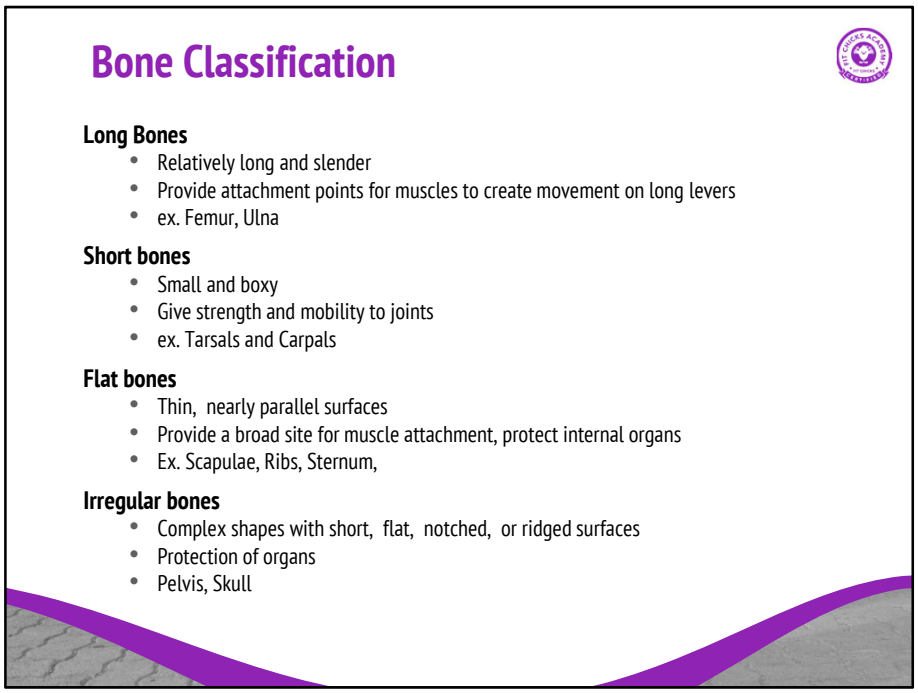
Mention that one of the trickiest things about anatomy is taking the information from a 2 dimensional page to the 3 dimensional body.

Label the diagram

Skeletal System: Lateral View



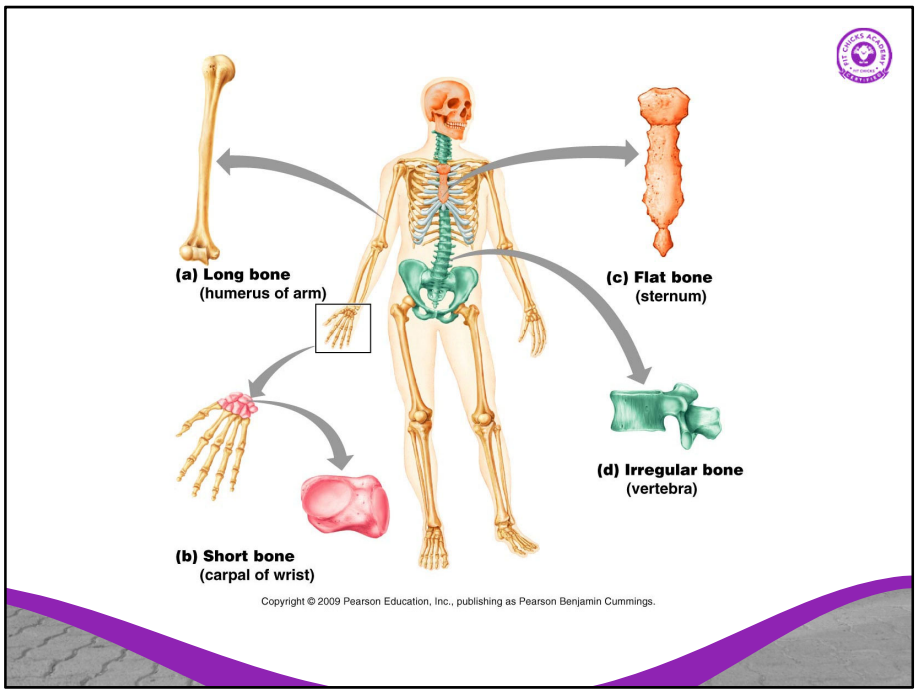
1. Scapula
2. Humerus
3. Lumbar Vertebrae
4. Iliac Crest
5. Ilium
6. Sacrum
7. Coccyx
8. Pubis
9. Fibula
10. Navicular (Tarsal bone)
11. Metatarsals
12. Phalanges
13. Mandible
14. Acromion
15. Clavicle
16. Femur
17. Patella
18. Tibia
19. Talus



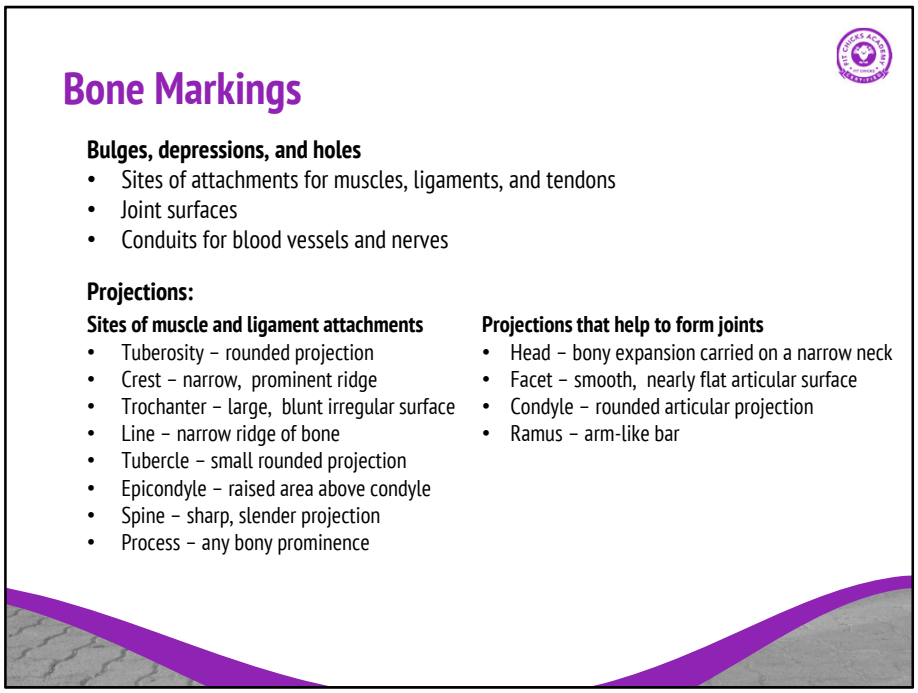
Long bones: located in the arm, forearm, thigh, leg, palms soles, fingers and toes. The femur is the longest and heaviest bone in the body

The body also has Sesamoid bones

- A bone embedded within a tendon or muscle (ex. Patella, pisiform, two small bones at the base of the 1st metatarsal)



http://droualb.faculty.mjc.edu/Course%20Materials/Elementary%20Anatomy%20and%20Physiology%2050/Lecture%20outlines/skeletal%20system%20I%20with%20figures.htm



Tuberosity – deltoid tuberosity – where the deltoid attaches on the humerus
Crest – iliac crest
Trochanter – greater tronchanter on the femur
Line - along the shins
Tubercle – infraglenoid tubercle (along the scapula)
Epicondyle – along elbow where ppl often complain of golfers or tennis elbow – flex/ext attach to the epicondyles
Spine – spine of the scapula
Process – spinous process

Head – head of the femur
Facet – facet joints in the spine
Condyle – end of the femur
Ramus – mandible

Bone Markings

Depressions and Openings

Meatus
- Canal-like passageway
- Ex. Ear

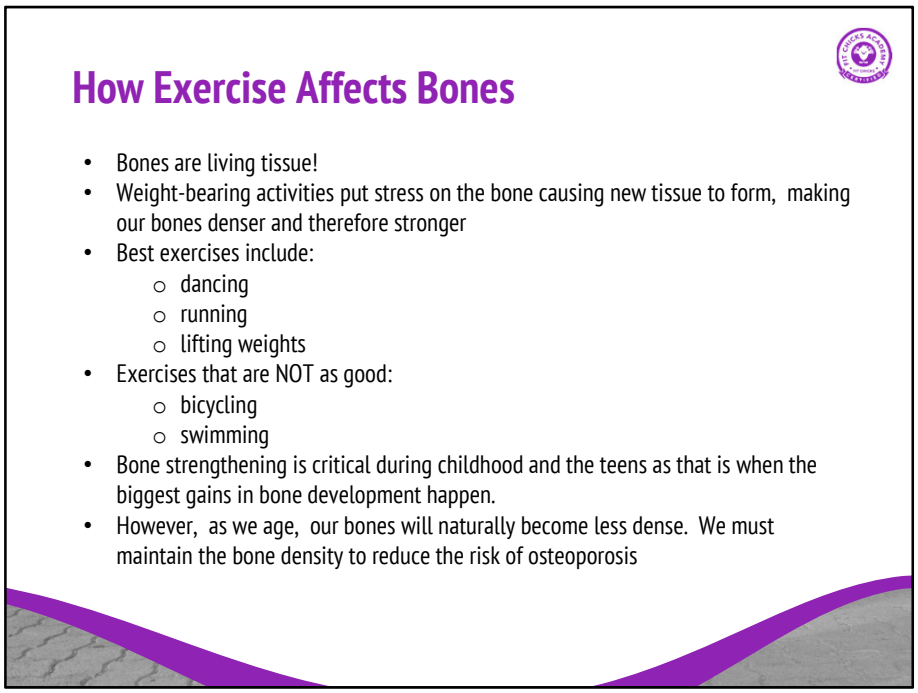
Sinus
- Cavity within a bone
- Ex. Nose

Fossa
- Shallow, basin-like depression
- Ex. Scapula

Groove
- Furrow
- Ex. Intertubercular (bicipital) groove

Fissure
- Narrow, slit-like opening
- Ex. Orbital Fissure

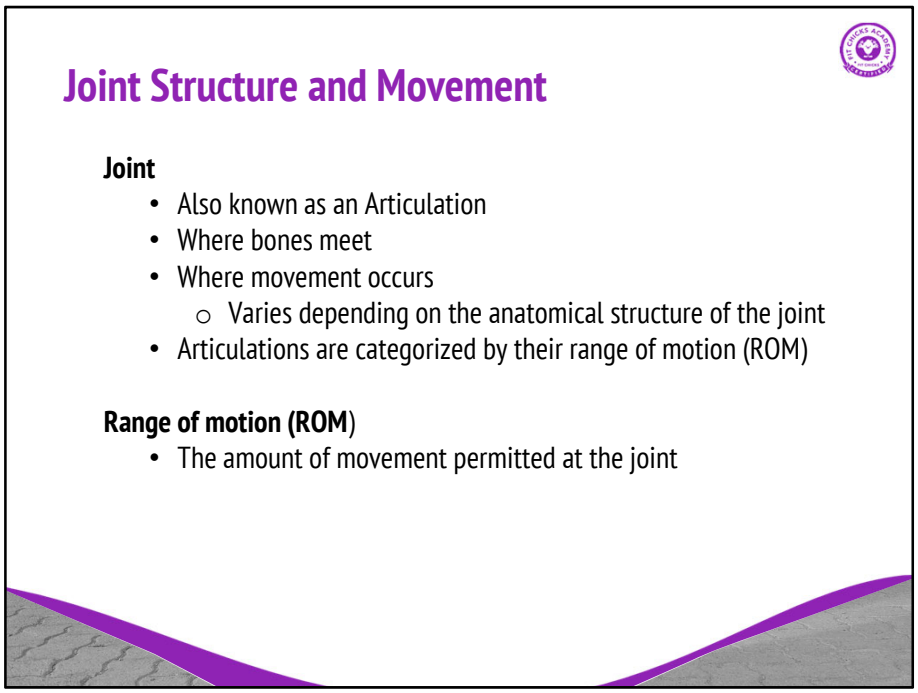
Foramen
- Round or oval opening through a bone
- Ex. Vertebrae, orbit, skull



- Os = bone
-extremely porous bones = osteoporosis.
-Osteoporosis can lead to bones that are weak and very likely to fracture.
- Like anything, if we don't use it, we lose it!

http://www.medicinenet.com/senior_exercise/page4.htm

https://www.nichd.nih.gov/health/topics/bonehealth/conditioninfo/Pages/activity.aspx



Categorized by their rom or the amount of movement at the joint

https://en.oxforddictionaries.com/definition/mobility

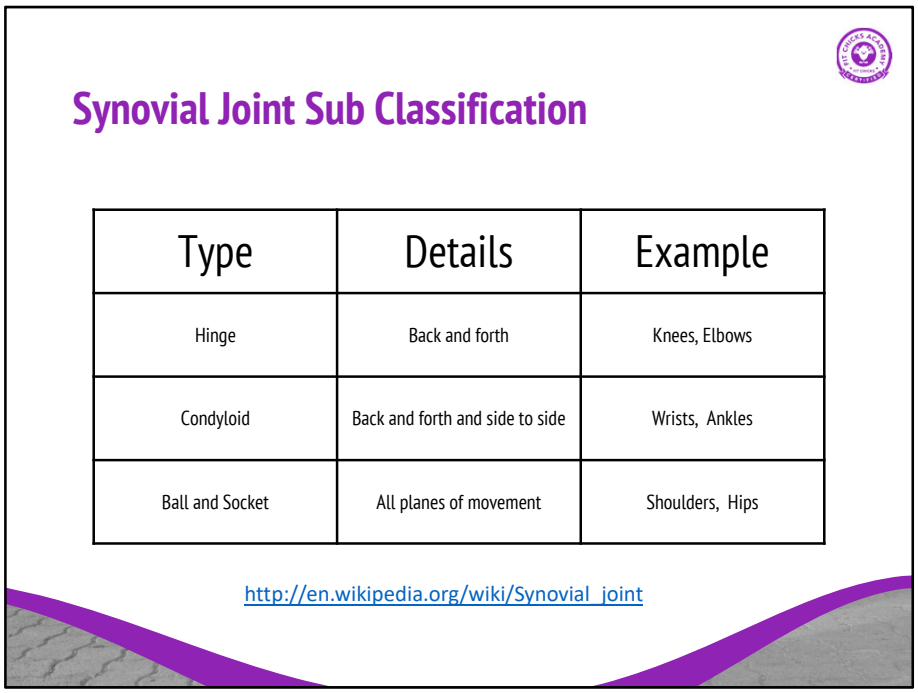
Joint Structure and Movement

Functional Category (degree of movement)	Structural Category	Description	Example
Synarthrosis (no movement)	Fibrous Suture	A fibrous connection plus interlocked surfaces	Skull, teeth in sockets
	Fibrous Gomphosis	A fibrous connection plus insertion in a boney socket	Between the teeth and jaws
	Cartilaginous Synchondrosis	Interposition of a cartilage plate	Between the first rib and sternum
Amphiarthrosis (little movement)	Fibrous Syndesmosis	Bones are connected by a ligament	Between the tibia and fibula (inferior joint)
	Cartilaginous Symphysis	Bones are connected by a wedge or pad of fibrocartilage	Between the right and left halves of the pelvis
Diarthrosis (free movement)	Synovial	Bounded by joint capsules, contain synovial fluid	knees, ankles, shoulders (Subdivided by ROM)

Synarthrosis – the bony edges are close together and may interlock. Extremely strong joints where you don't want any movement
Amphiarthrosis – more movement than a synarthrosis but much stronger than a freely movable joint. Connected by collagen fibers or cartilage

Fibrous - Bones joined by fibrous tissue. Little to no movement
Cartilaginous - Joined by cartilage, a little bit of movement but not much
Synovial – contains synovial fluid, freely moveable

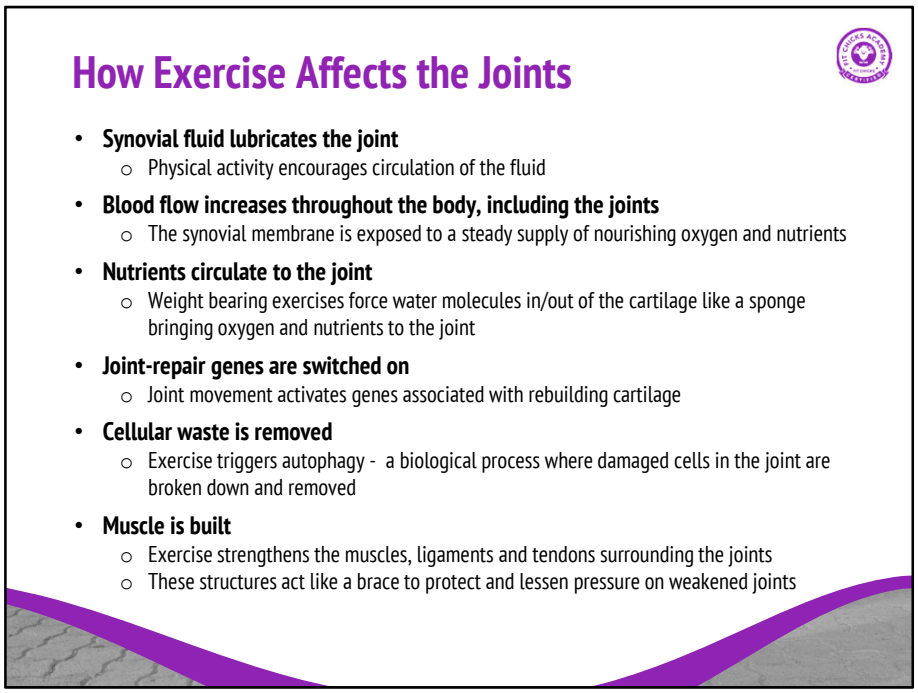
Martini, F.H., Ober, W.C., Bartholomew, E.F., Nath, J.L. (2013). Visual Essentials of Anatomy and Physiology. 191



Components of a synovial joint: the articulation itself, ligaments, synovial membrane, bursae, synovia

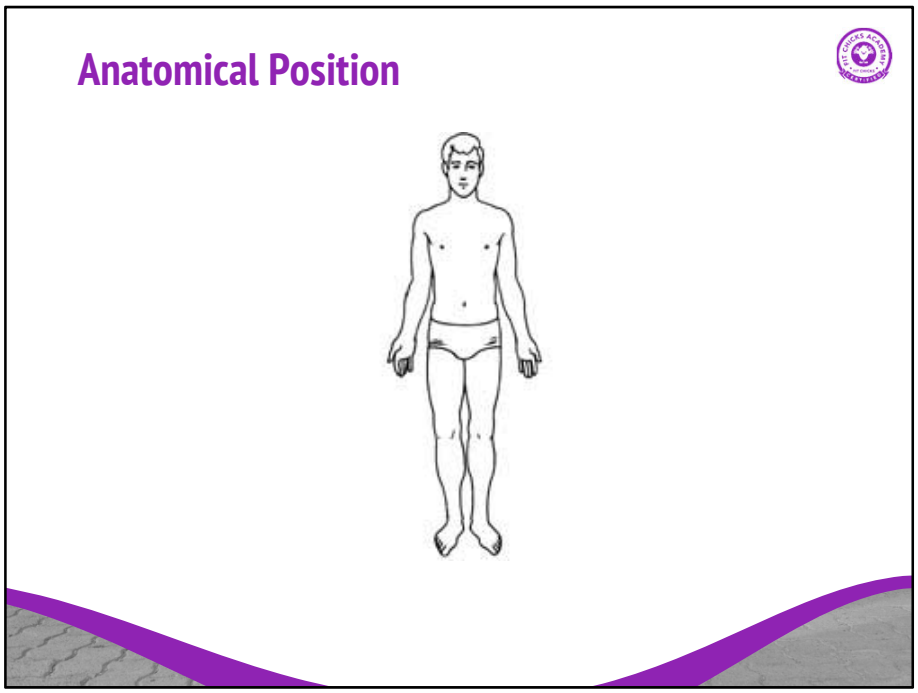
There are actually 7 types of synovial joints but these are the ones most relevant to a Personal Trainer

http://en.wikipedia.org/wiki/Synovial_joint



Http://blog.arthritis.org/living-with-arthritis/exercise-benefits-for-joints/

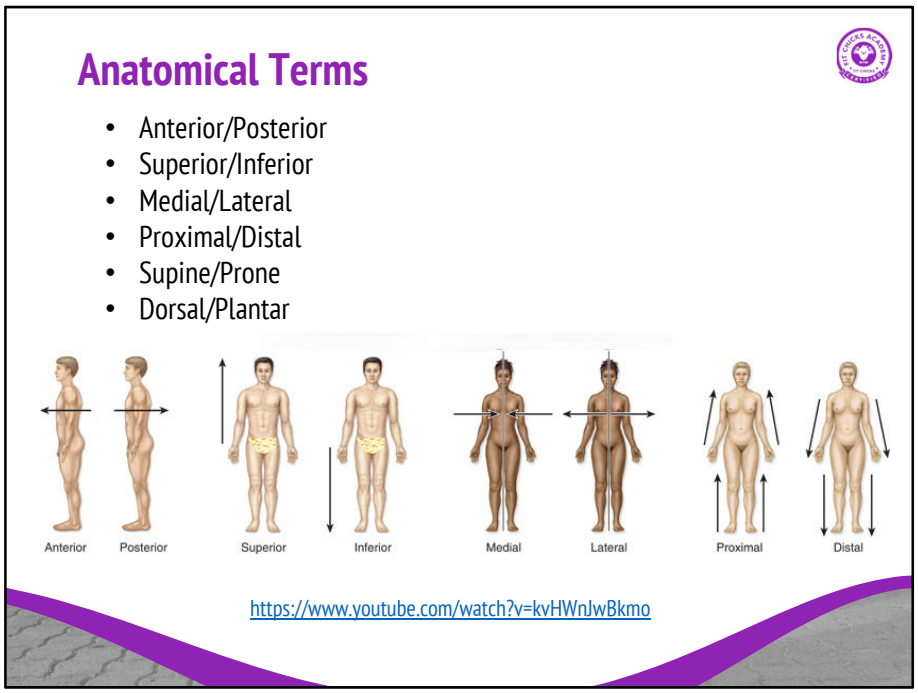
Synovial fluids acts like oil in an engine, allows your bones to move past one another more smoothly
Scientists aren't entirely clear about how genes play a role in joint repair
(Overdoing exercise can have the opposite effect)



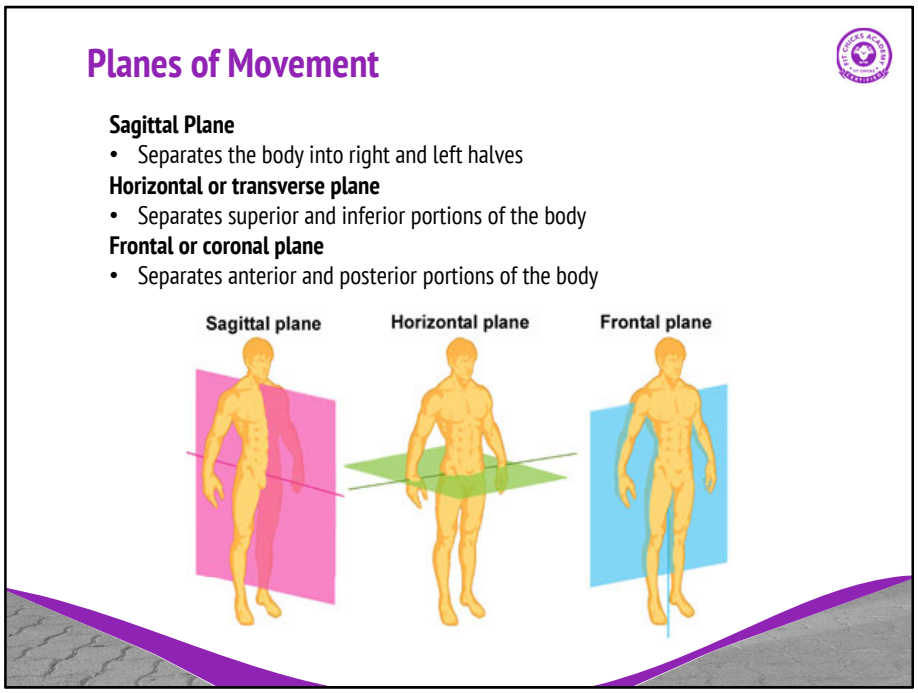
https://www.youtube.com/watch?v=kvHWnJwBkmo

Anatomical position: The position with the body erect with the arms at the sides and the palms forward. The anatomical position is of importance in anatomy because it is the position of reference for anatomical nomenclature. Anatomic terms such as anterior and posterior, medial and lateral, abduction and adduction, and so on apply to the body when it is in the anatomical position.

http://www.medicinenet.com/script/main/art.asp?articlekey=24762



- Anterior/Posterior (front and back)
- Medial/Lateral (towards and away from midline) – medial = middle
- Superior/Inferior (above and below)
- Supine/Prone (On your back, on your front). – supine = on your spine
- Dorsal/Plantar (of the feet, top and bottom) – dorsal fin of a shark is on the top of the sharks body/plantar = plant your foot on the ground
- Proximal/Distal (appendages, towards the trunk and away)



The sagittal plan can also be subdivided into:
Midsagittal – passes through the midline of the body, dividing it into equal right and left halves
Parasagittal – a cut parallel to the midsagittal plane, separates the body into right and left halves of unequal size.

What are some movements in each plane?
Sagittal – shoulder flexion, trunk ext, hip flexion
Horizontal – trunk rotation,
Frontal – shld abduction, hip adduction, trunk lateral flexion

https://www.teachpe.com/anatomy-physiology/the-skeleton-bones/planes-of-movement
Martini, F.H., Ober, W.C., Bartholomew, E.F., Nath, J.L. (2013). Visual Essentials of Anatomy and Physiology.
19

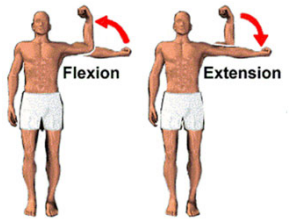
Joint Movement Terminology

Flexion:

- Refers to movement where the angle between two bones decreases. Flexion is commonly known as bending.

Extension:

- Refers to movement where the angle between two bones increases. Extension is otherwise known as straightening.



Totally zen video about joint movement terminology:
https://www.youtube.com/watch?v=5YcNAPzDxDg

London bridge fast version:
https://www.youtube.com/watch?v=oA6HiaV1RlU

Normal version: https://www.youtube.com/watch?v=-GCgaoRdeaU

Great resource for articulations with respect to EXERCISES:
http://www.exrx.net/Lists/Articulations.html

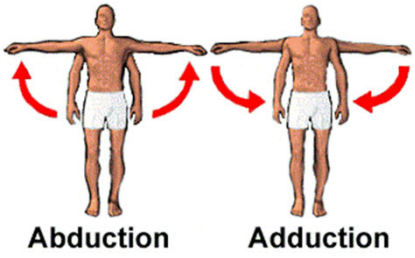
ABduction and ADduction

Abduction:

- Is movement of a body segment away from the midline of the body.

Adduction:

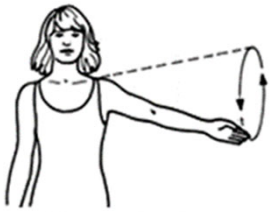
- Is movement of a body segment toward the midline of the body.



For adduction, think “adding the body parts together”

Circumduction

This is a movement where the joint is the pivot and the body segment moves in a combination of flexion, extension, adduction and abduction.



Circumduction

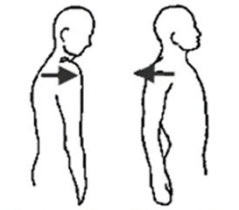
Protraction and Retraction

Protraction:

- This is forward movement of the scapula that results in 'hunching' of the shoulders.

Retraction:

- This is backward movement of the scapula as they pull together to 'square' the shoulders and push the chest out.



The jaw is another good example of protraction and retraction – Protraction = pushing your lower jaw forward and Retraction = pulling you lower jaw back

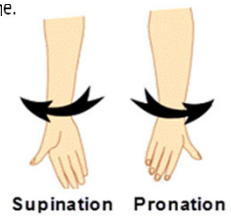
Supination and Pronation

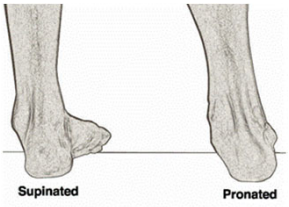
Supination:

- Hand – movement so the palm of the hand faces upward or forward (anteriorly).
- Foot – combination of inversion, plantar flexion and adduction of the foot occurring at the same time.

Pronation:

- Hand – movement so the palm of the hand faces downward or backward (posteriorly).
- Foot – combination of eversion, dorsiflexion and abduction of the foot occurring at the same time.





Easy way to remember this one – for supination you are holding a bowl of soup so your palm needs to be up.

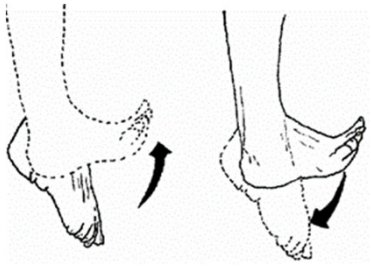
Plantar Flexion and Dorsiflexion

Plantar Flexion:

- Is moving the top of the foot away from the shin or 'pointing' the toes.

Dorsiflexion:

- Is moving the top of the foot toward the shin or 'raising' the toes.



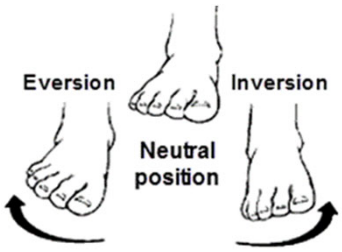
Inversion and Eversion

Inversion:

- Is the movement of the foot to bring the sole of the foot to face inward.

Eversion:

- Is the movement of the foot to bring the sole of the foot to face outward.



Inversion – bottom of foot faces in – inversion sprains are most common, usually when you roll your ankle, you invert it.

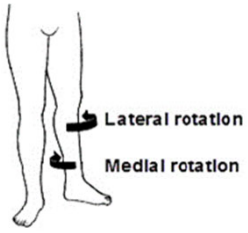
Medial and Lateral Rotation

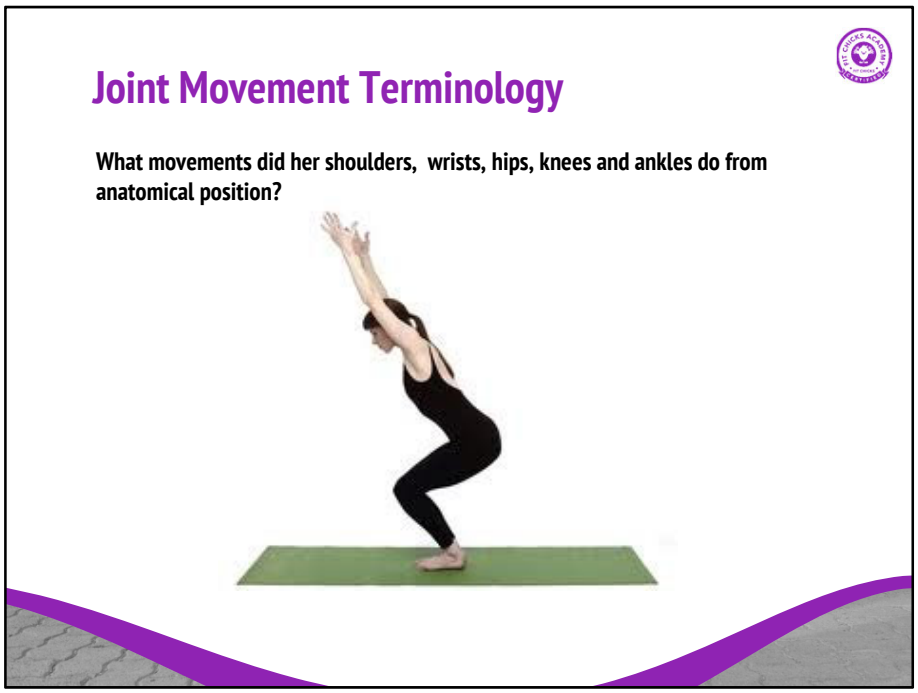
Medial (Internal) Rotation:

- The movement of a body segment where the front (anterior) of the segment rotates medially (inwards) towards the midline of the body.

Lateral (External) Rotation:

- The movement of a body segment where the front (anterior) of the segment rotates laterally (outwards) away from the midline of the body.





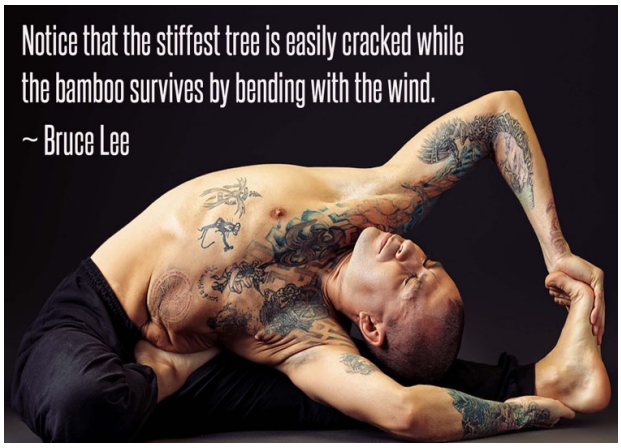
Shoulder flexion, wrist pronation, hip flexion, knee flexion, ankle dorsiflexion

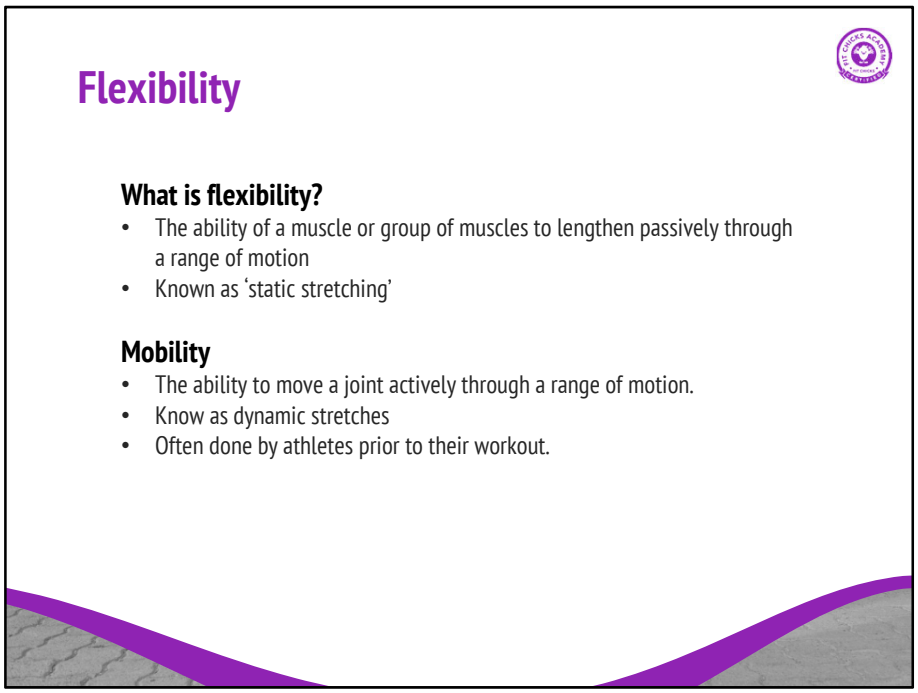
Now tell them to flex both shoulders, hyperextend their left hip and flex their right hip. they should end up in Warrior 3

https://www.youtube.com/watch?v=5YcNAPzDxDg

http://www.exrx.net/Lists/Articulations.html

Flexibility





https://kinstretch.com/difference-mobility-flexibility/

Just because a muscle can achieve a full length doesn't mean the joint it attaches to is mobile.
Example – someone can't touch their toes bc their hamstring feel really 'tight" but laying supine in a passive stretch they can achieve normal muscle length. This person has adequate muscle length but lacks joint mobility to achieve a toe touch. There are other muscles affecting the joint limiting the mobility.

Benefits of Flexibility Training

- Improved ROM (Range of Motion)/Mobility at joints
- Increase in athletic performance and helps in daily living
- Decrease risk of injury
- Better posture and possible relief of back pain
- Feelings of tension release, relaxation and restoration

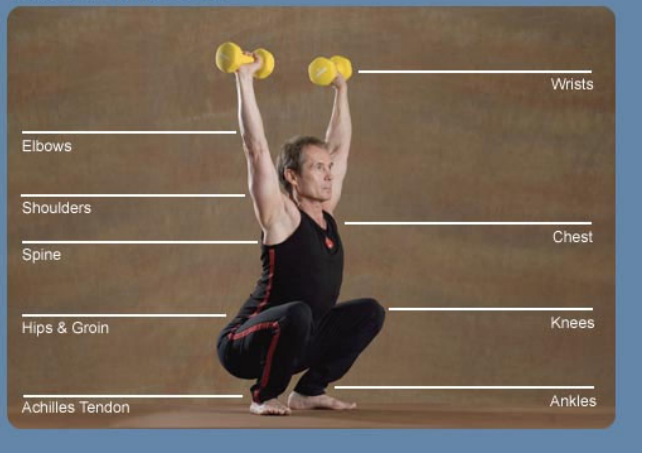
NOTE: There is no scientific evidence to prove that stretching aids in exercise-induced muscle soreness or recovery

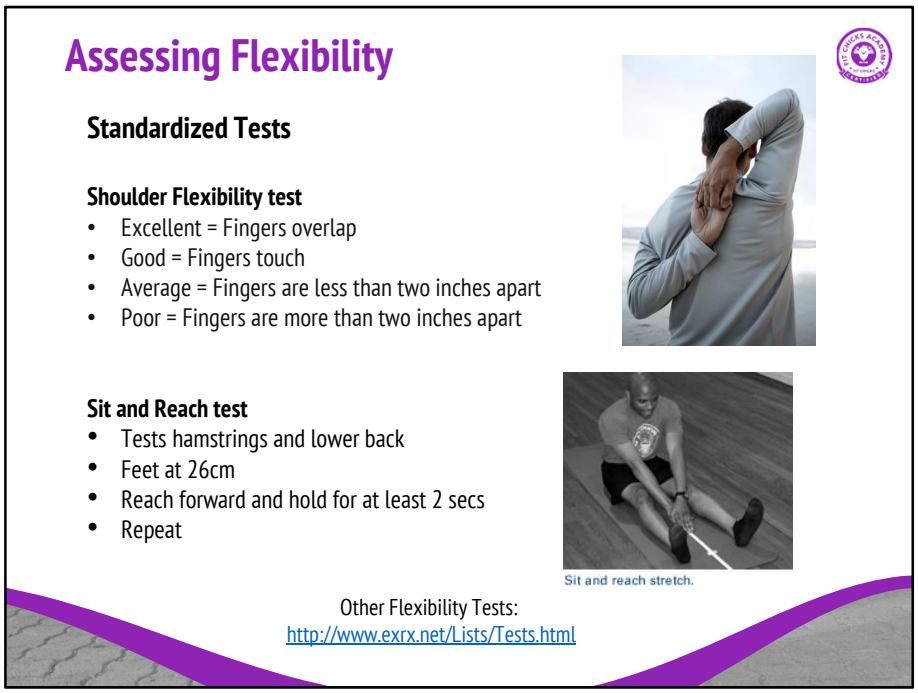
Give examples:

-My grandmother who can't tie her shoes
-someone who moves quickly and pulls a tight muslce
-tight hamstrings pulling the pelvis out of alignment, leading to back pain.

http://www.livestrong.com/article/332519-what-are-the-benefits-of-good-flexibility/

FIGURE 2.1: POINTS OF FLEXIBILITY





http://www.exrx.net/Lists/Tests.html (tons of other flexibility tests)

One test that I always do with my clients is a deep squat test. If someone isn't able to get into a deep squat then it will tell you a lot about their flexibility and mobility. Is it tight hips, back, ankles…. So many fun things to work on!!

https://www.youtube.com/watch?v=uBrF5VfxrmM Sit and Reach test

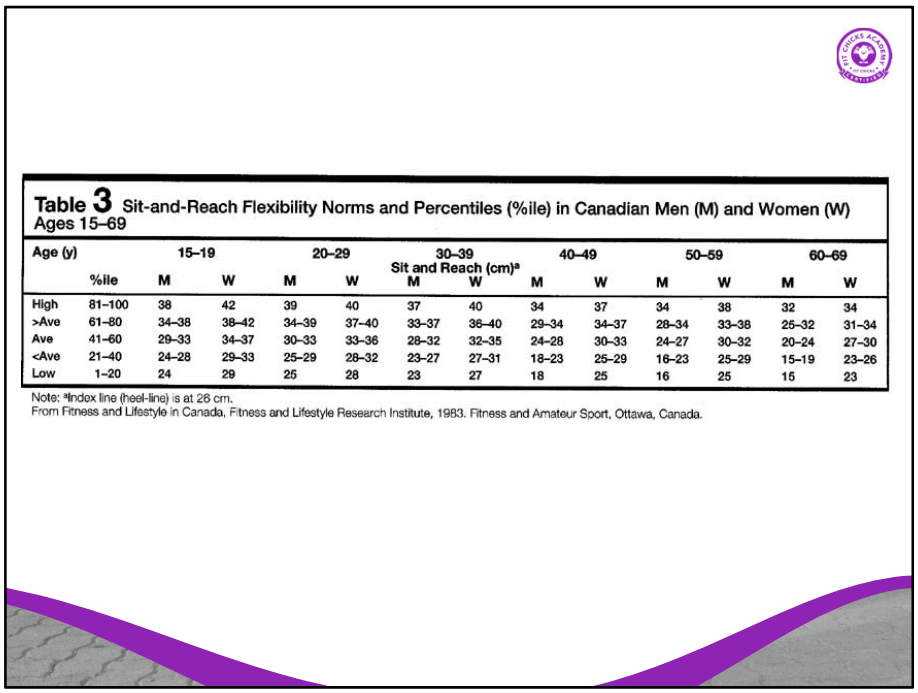


Table 3 Sit-and-Reach Flexibility Norms and Percentiles (%ile) in Canadian Men (M) and Women (W) Ages 15–69

Age (y)		15–19		20–29		30–39		40–49		50–59		60–69	
						Sit and Reach (cm)[a]							
	%ile	M	W	M	W	M	W	M	W	M	W	M	W
High	81–100	38	42	39	40	37	40	34	37	34	38	32	34
>Ave	61–80	34–38	38–42	34–39	37–40	33–37	36–40	29–34	34–37	28–34	33–38	25–32	31–34
Ave	41–60	29–33	34–37	30–33	33–36	28–32	32–35	24–28	30–33	24–27	30–32	20–24	27–30
<Ave	21–40	24–28	29–33	25–29	28–32	23–27	27–31	18–23	25–29	16–23	25–29	15–19	23–26
Low	1–20	24	29	25	28	23	27	18	25	16	25	15	23

Note: [a]Index line (heel-line) is at 26 cm.
From Fitness and Lifestyle in Canada, Fitness and Lifestyle Research Institute, 1983. Fitness and Amateur Sport, Ottawa, Canada.

Good for course notes, although the image is referenced...

FITT for Flexibility Training

Frequency

- It's recommended that you perform flexibility training once a day for 3-7 days a week
- Ideally, flexibility training should be performed AFTER the workout, as the muscles are warm and most pliable

Intensity

- Your flexibility program should feel like slight tension with NO PAIN. It should never hurt!

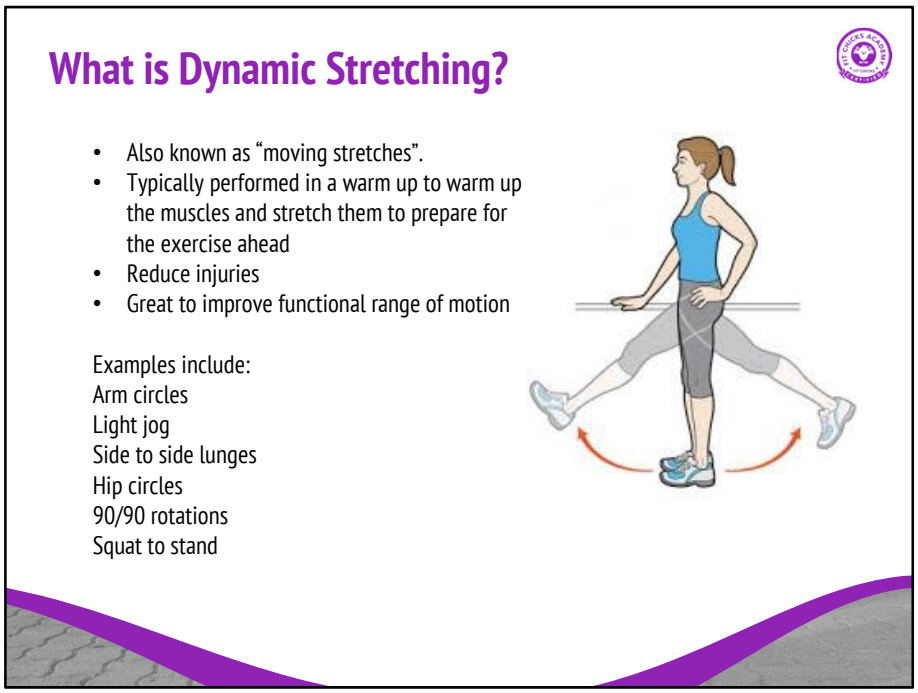
Time

- Hold each stretch for a minimum of 30 seconds (or 6 deep breaths)

Type

- Static stretching
- Mobility/Dynamic stretching
- It is recommended that everyone does flexibility training as part of their daily routine
- Athletes may choose to incorporate some mobility training prior to their workout.

- http://www.sportsscience.co/flexibility/how-often-and-how-long-should-i-stretch-to-improve-flexibility/



Dynamic Stretching
Dynamic stretching is also known as "moving stretches". These stretches are typically performed in a warm up to warm up the muscles and stretch them to prepare for the exercise ahead and reduce injuries.

Dynamic stretches are also great in addition to doing in a warm up to help improve functional range of motion, mobility in sports and in performing everyday activities.
.
Dynamic stretching is similar to active stretching. However, in dynamic stretching you don't hold the stretch. You are always moving or dynamic

Note that dynamic stretching should not be confused with old-fashioned ballistic stretching (remember the bouncing toe touches from PE classes?). Dynamic stretching is controlled, smooth, and deliberate, whereas ballistic stretching is uncontrolled, erratic, and jerky. Although there are unique benefits to ballistic stretches, they should be done only under the supervision of a professional because, for most people, the risks of ballistic stretching far outweigh the benefits.

http://www.humankinetics.com/excerpts/excerpts/types-of-stretches

Advancing a Flexibility Program

- Hold stretch for longer
- Go deeper
- Change your relationship to gravity
  - Standing hip stretch vs a lying down 'Figure 4' to a Pidgeon pose
- Add multiple joints
  - Stretching your triceps while you do a hip flexor stretch
- Introducing some light resistance from a partner
- Add a balance element
  - Lying quadriceps vs standing quadriceps



Like any element of fitness, you have to apply the principle of progressive overload to continue to see improvements.

Flexibility Resources

- Strength Training Anatomy:
- p. 60: The shoulder (Deltoids)
- p. 63 The Chest (Pectoralis Major)
- p. 89 The Back (Latissimus Dorsi)
- p. 120-121 Neck and Shoulders (Upper Trapezius, Deltoids)
- p.139 Quadriceps
- p. 163 Glutes and Hamstrings

- Yoga poses by Anatomy: http://www.yogajournal.com/category/anatomy/
- Becoming a Supple Leopard by Dr. Kelly Starrett

Recap

INTRODUCTION TO THE FITT PRINCIPLE

SKELETAL ANATOMY
- Know your bones!
- Review your articulations and Anatomical terms.

FLEXIBILITY
- Benefits of Flexibility Training
- Assessing Flexibility
- Designing a Flexibility Training Program

WHAT'S COMING UP IN NEXT CLASS?

MUSCLES!!

Any questions or inquiries,
please email:

fne@fitchicks.ca

Let's have an amazing journey
ahead!