# FITNESS & NUTRITION EXPERT PROGRAM

## FITNESS SESSION 3:

Skeletal Anatomy &Flexibility

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

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## 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

## The FITT Principle

**Frequency**
- How many days per week?

**Intensity**
- How hard?

**Time**
- How long?

**Type**
- What kind of exercise?

## 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

## 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.

## The FITT Principle – Example

**For an experienced runner with a 5k PB goal**

**Frequency**
- 5 days a week

**Intensity**
- Varied but mostly High!

**Time**
- Approx. 30 - 40mins

**Type**
- Running

## Facts about the Skeletal

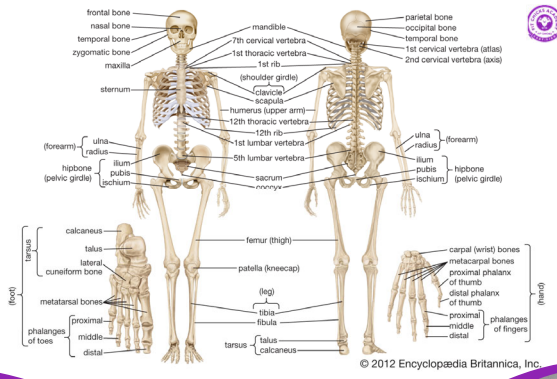
- Human adult skeleton has 206 bones (we used to have 300!)
- We achieve maximum bone density at age 30
- Female skeleton has a larger pelvic capacity but is otherwise usually smaller
- Our bones are alive!
  - Bones are highly vascular
  - Bones undergo extensive remodeling throughout life
  - Bones respond to stress and grow thicker and stronger with physical activity and become thin and brittle with inactivity

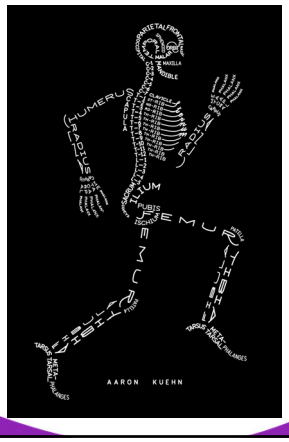
## Components of the Skeleton

- Axial Skeleton (keeps you upright!)
  - Skull, thoracic cage, vertebral column, and various cartilages
  - Forms the longitudinal axis of the body
  - 80 bones
  - Supports and protects the brain, spinal cord, and organs in the ventral body cavity
  - Provides an extensive surface for the attachment of muscles
- Appendicular Skeleton (helps you move!)
  - Limbs and girdles (pectoral and pelvic)
  - 126 bones
- The skeletal system also includes:
  - Cartilage- Flexible supporting framework
  - Tendons - Connects bones to muscles
  - Ligaments - Connects bones to other bones

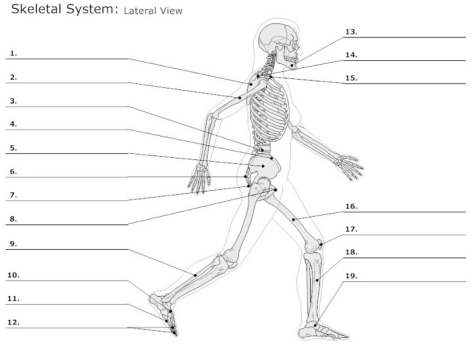
## Essential Functions of the Skeleton/Bone

1. Protection of organs (skull, ribs, etc!)
2. Structure and shape
   - Endormorphs - Apple or pear shape
   - Ectomorphs - Tall and thin
   - Mesomorphs - Short and muscular
3. Movement
   - Muscles pull on bones to create movement at joints
4. Red Blood cell Production
5. Mineral Storage
6. Endocrine Regulation (Bone Only)






Skeletal System: Lateral View



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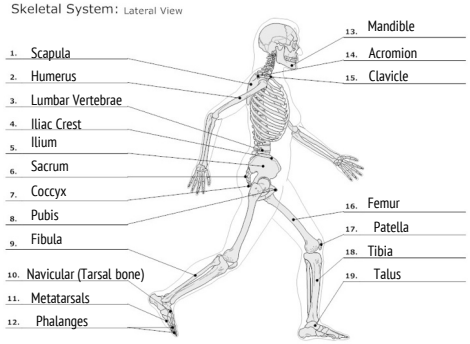
Skeletal System: Lateral View



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

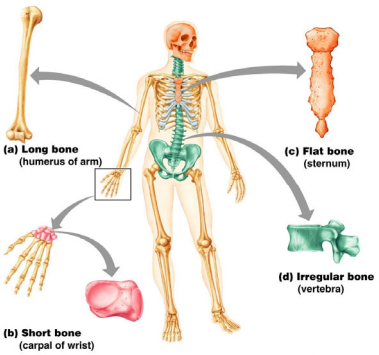
## Bone Classification

**Long Bones**
- Relatively long and slender
- Provide attachment points for muscles to create movement on long levers
- ex. Femur, Ulna

**Short bones**
- Small and boxy
- Give strength and mobility to joints
- ex. Tarsals and Carpals

**Flat bones**
- Thin, nearly parallel surfaces
- Provide a broad site for muscle attachment, protect internal organs
- Ex. Scapulae, Ribs, Sternum,

**Irregular bones**
- Complex shapes with short, flat, notched, or ridged surfaces
- Protection of organs
- Pelvis, Skull





## Bone Markings

**Bulges, depressions, and holes**
- Sites of attachments for muscles, ligaments, and tendons
- Joint surfaces
- Conduits for blood vessels and nerves

**Projections:**

**Sites of muscle and ligament attachments**
- Tuberosity – rounded projection
- Crest – narrow, prominent ridge
- Trochanter – large, blunt irregular surface
- Line – narrow ridge of bone
- Tubercle – small rounded projection
- Epicondyle – raised area above condyle
- Spine – sharp, slender projection
- Process – any bony prominence

**Projections that help to form joints**
- Head – bony expansion carried on a narrow neck
- Facet – smooth, nearly flat articular surface
- Condyle – rounded articular projection
- Ramus – arm-like bar

## 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

## How Exercise Affects Bones

- Bones are living tissue!
- Weight-bearing activities put stress on the bone causing new tissue to form, making our bones denser and therefore stronger
- Best exercises include:
  - dancing
  - running
  - lifting weights
- Exercises that are NOT as good:
  - bicycling
  - swimming
- Bone strengthening is critical during childhood and the teens as that is when the biggest gains in bone development happen.
- However, as we age, our bones will naturally become less dense. We must maintain the bone density to reduce the risk of osteoporosis

## Joint Structure and Movement

**Joint**
- Also known as an Articulation
- Where bones meet
- Where movement occurs
  - Varies depending on the anatomical structure of the joint
- Articulations are categorized by their range of motion (ROM)

**Range of motion (ROM)**
- The amount of movement permitted at the joint

## 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) |

## Synovial Joint Sub Classification

| Type | Details | Example |
|---|---|---|
| Hinge | Back and forth | Knees, Elbows |
| Condyloid | Back and forth and side to side | Wrists, Ankles |
| Ball and Socket | All planes of movement | Shoulders, Hips |

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

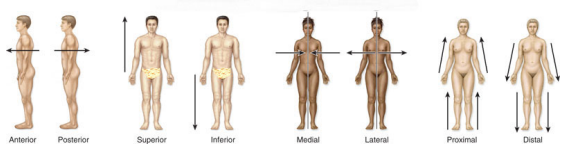
## How Exercise Affects the Joints

- **Synovial fluid lubricates the joint**
  - Physical activity encourages circulation of the fluid
- **Blood flow increases throughout the body, including the joints**
  - The synovial membrane is exposed to a steady supply of nourishing oxygen and nutrients
- **Nutrients circulate to the joint**
  - Weight bearing exercises force water molecules in/out of the cartilage like a sponge bringing oxygen and nutrients to the joint
- **Joint-repair genes are switched on**
  - Joint movement activates genes associated with rebuilding cartilage
- **Cellular waste is removed**
  - Exercise triggers autophagy - a biological process where damaged cells in the joint are broken down and removed
- **Muscle is built**
  - Exercise strengthens the muscles, ligaments and tendons surrounding the joints
  - These structures act like a brace to protect and lessen pressure on weakened joints

## Anatomical Position

## Anatomical Terms

- Anterior/Posterior
- Superior/Inferior
- Medial/Lateral
- Proximal/Distal
- Supine/Prone
- Dorsal/Plantar



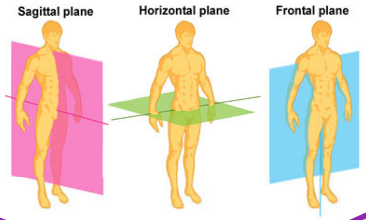

https://www.youtube.com/watch?v=kvHWnlwBkmo

## Planes of Movement

**Sagittal Plane**
- Separates the body into right and left halves

**Horizontal or transverse plane**
- Separates superior and inferior portions of the body

**Frontal or coronal plane**
- Separates anterior and posterior portions of the body



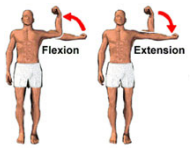
## Joint Movement Terminology

**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.



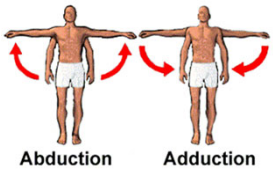

## ABduction and ADduction

**Abduction:**

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

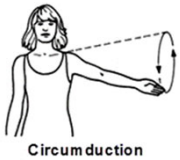
**Adduction:**

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




## 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.



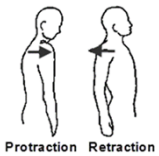
## Protraction and Retraction

**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.



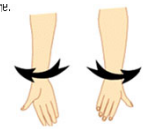

## Supination and Pronation

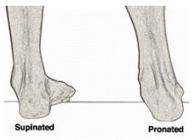
**Supination:**

- 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.



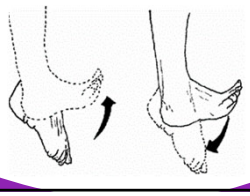

## Plantar Flexion and Dorsiflexion

**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.



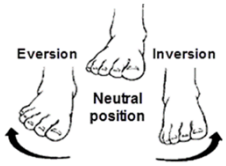
## Inversion and Eversion

**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.



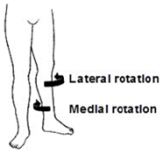

## Medial and Lateral Rotation

**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.



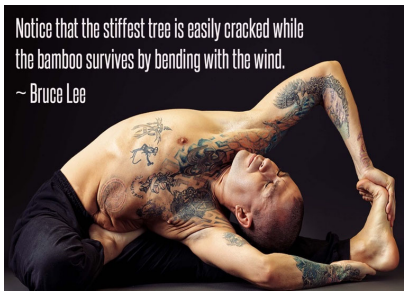

## Joint Movement Terminology

**What movements did her shoulders, wrists, hips, knees and ankles do from anatomical position?**

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

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

## Flexibility




## Flexibility

**What is flexibility?**

- The ability of a muscle or group of muscles to lengthen passively through a range of motion
- Known as 'static stretching'

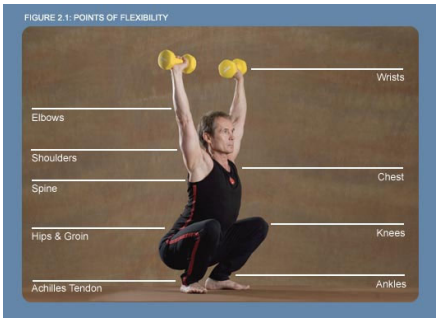
**Mobility**

- The ability to move a joint actively through a range of motion.
- Know as dynamic stretches
- Often done by athletes prior to their workout.

## 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*




## Assessing Flexibility

**Standardized Tests**

**Shoulder Flexibility test**
- Excellent = Fingers overlap
- Good = Fingers touch
- Average = Fingers are less than two inches apart
- Poor = Fingers are more than two inches apart

**Sit and Reach test**
- Tests hamstrings and lower back
- Feet at 26cm
- Reach forward and hold for at least 2 secs
- Repeat

Sit and reach stretch.

Other Flexibility Tests:
http://www.exrx.net/Lists/Tests.html

**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.

## 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.

## What is Dynamic Stretching?

- Also known as "moving stretches".
- Typically performed in a warm up to warm up the muscles and stretch them to prepare for the exercise ahead
- Reduce injuries
- Great to improve functional range of motion

Examples include:
Arm circles
Light jog
Side to side lunges
Hip circles
90/90 rotations
Squat to stand

## 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



## 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!