**Chapter 8**
**Joints**
**Lecture 15**

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**Lecture Overview**

- Functions of joints
- Classification of joints
- Types of joints
- Types of joint movements
- Some representative articulations

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**Functions of Joints (Articulations)**

- Form functional junctions between bones
- Bind parts of skeletal system together
- Make bone growth possible
- Permit parts of the skeleton to change shape during childbirth
- Enable body to move in response to skeletal muscle contraction

A “joint” joins two bones or, parts of bones, together, regardless of ability of the bones to move around the joint.
Some Useful Word Roots

- **Arthros** – joint
- **Syn** – together (immovable)
- **Dia** – through, apart (freely moveable)
- **Amphi** – on both sides (slightly moveable)

Some Examples:

- ***Synarthrosis*** – An immovable joint
- ***Amphiarthrosis*** – A slightly movable joint
- ***Diarthrosis*** – Freely movable joint

What does the term ‘synostosis’ mean?

Classification of Joints

<table>
<thead>
<tr>
<th>How are the bones held together?</th>
<th>How does the joint move?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Structural</td>
<td>Functional</td>
</tr>
<tr>
<td>- Fibrous Joints</td>
<td>- synarthrotic</td>
</tr>
<tr>
<td>• dense connective tissues</td>
<td>• immovable</td>
</tr>
<tr>
<td>• connect bones in close</td>
<td>• amphiarthrotic</td>
</tr>
<tr>
<td>contact</td>
<td>• slightly movable</td>
</tr>
<tr>
<td>- Cartilaginous Joints</td>
<td>• diarthrotic</td>
</tr>
<tr>
<td>• hyaline cartilage or</td>
<td>• freely movable</td>
</tr>
<tr>
<td>fibrocartilage</td>
<td></td>
</tr>
<tr>
<td>- Synovial Joints</td>
<td></td>
</tr>
<tr>
<td>• most complex</td>
<td></td>
</tr>
<tr>
<td>• allow free movement</td>
<td></td>
</tr>
<tr>
<td>• have a cavity</td>
<td></td>
</tr>
</tbody>
</table>

Structural Classification of Joints

<table>
<thead>
<tr>
<th>Fibrous</th>
<th>Cartilaginous</th>
<th>Synovial (D)</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Gomphosis (S)</td>
<td>- Spondylosis (S)</td>
<td>- Gliding (N)</td>
</tr>
<tr>
<td>- Suture (S)</td>
<td>- Symphysys (A)</td>
<td>- Hinge (M)</td>
</tr>
<tr>
<td>- Syndesmosis (A)</td>
<td></td>
<td>- Pivot (M)</td>
</tr>
</tbody>
</table>

| (S) = Synarthrosis             | (N) = Nonaxial         |
| (A) = Amphiarthrosis           | (M) = Monaxial         |
| (D) = Diarthrosis              | (B) = Biaxial          |
|                                 | (P) = Polyaxial        |

This would be a really good chart to know for the exam!
Fibrous Joints

- No synovial cavity (space between bones)
- fibrous CT
- little or no movement

3 Types
- **Gomphosis**
- **Suture**
- **Syndesmosis**

**Syndesmosis** (desmos = band or ligament; to bind)
- long fibers connect bones
- amphiarthrotic (slightly movable)
- distal ends of tibia and fibula
- radius and ulna
- broad sheets or bundles

Mnemonic for types of fibrous joints: “Go su e synd for telling a fib”

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Fibrous Joints

**Suture** (sewing together)
- between flat bones
- synarthrotic
- thin layer of connective tissue connects bones

**Gomphosis** (bolting together)
- cone-shaped bony process in a socket
- tooth in jawbone
- peg-in-socket
- synarthrotic

Mnemonic for cartilaginous joints: “Cartilage either synch or sym” (sinks or swims)

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Cartilaginous Joints

- No synovial cavity
- hyaline or fibrocartilage
- little or no movement

2 Types
- **Synchondrosis**
- **Symphysis**

**Synchondrosis**
- bands of hyaline cartilage unite bones
- epiphyseal plate (temporary)
- between manubrium and first rib (sternocostal)
- **synarthrotic** (no movement)

Mnemonic for cartilaginous joints: “Cartilage other synch or sym” (sinks or swims)
**Cartilaginous Joints**

- Symphysis
  - pad of fibrocartilage between bones
  - pubic symphysis (or symphysis pubis)
  - joint between bodies of vertebrae
  - amphiarthrotic

*Figure from: Hole's Human A&P, 12th edition, 2010*

**Synovial Joints**

* Diarthrotic (freely movable)

- joint cavity*
- articular cartilage
- synovial membrane
- synovial fluid
- reinforcing ligaments, bursae and tendons

Synovial fluid: Lubricates, distributes nutrients, and absorbs shock

*Figure from: Hole's Human A&P, 12th edition, 2010*

**Types of Synovial Joints**

Mnemonic for types of synovial joints (least movable to most movable):
“Geeky Humans Play Competitive Saddle Ball”

- **Gliding (Plane) Joint**
  - between carpals
  - between tarsals
  - between vertebrae

- **Hinge Joint**
  - elbow
  - knee
  - between phalanges

- **Flat surfaces move past one another (nonaxial)**
- **Angular open/close motion (monaxial)**

*Figure from: Hole's Human A&P, 12th edition, 2010*
Types of Synovial Joints

**Pivot Joint**
- between proximal ends of radius and ulna

**Saddle Joint**
- between carpals and metacarpals of thumb
- sternoclavicular joint

**Rotation around long axis**
(monaxial)

**Angular motion**
(biaxial)

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**Types of Synovial Joints**

**Ball-and-Socket Joint**
- hip
- shoulder

**Condyloid Joint**
- between metacarpals and phalanges
- between radius and carpals

**Movement around 3 axes and in between**
(multiaxial)

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**Movement of Synovial Joints**

- *All movements are based upon*
  - The body being in anatomical position
  - All axial and appendicular joints being in full extension when in anatomical (zero) position

- Important to define which joint you are examining before trying to define movement
Flexion and Extension

Usually occur in the sagittal plane

• **Flexion** – decrease in angle between bones and parts come together (*usually in direction of greatest mobility*)

• **Extension** – increase in angle between bones and parts move further apart (usually after flexion)

• **Hyperextension** – Extension beyond the anatomical position (limited by tendons/ligaments/bones)

• **Lateral Flexion** – movement from side-to-side (in the frontal plane)

Flexion and Extension

Figure from: Martini, Anatomy & Physiology, Benjamin Cummings, 2004

ABduction, ADduction, and Circumduction

Usually occur in the frontal plane

• **ABduction** – movement away from midline

• **ADdution** – movement toward midline

• **Circumduction** – Movement of the distal end of a limb in a circle
ABduction, ADduction, and Circumduction

Figure from:
Martini, Anatomy & Physiology,
Benjamin Cummings, 2004

Rotation, Pronation/Supination

Figures From:
Marieb & Hoehn, Human Anatomy & Physiology,

Bone revolves around its own longitudinal axis

Special Movements of Synovial Joints

Figures From:
Marieb & Hoehn, Human Anatomy & Physiology,

Anterior/posterior movement in the transverse plane

Superior/inferior movement in the coronal plane
Special Movements of Synovial Joints

Joint Classification

Joint Classification of Joints

- **Fibrous**
  - Gomphosis (S)
  - Suture (S)
  - Syndesmosis (A)

- **Cartilaginous**
  - Spondylothesis (S)
  - Spondylodiscitis (A)

- **Synovial** (D)
  - Gliding (N)
  - Hinge (M)
  - Pivot (M)
  - Condyloid (B)
  - Saddle (B)
  - Ball/Socket (P)

(S) = Synarthrosis
(A) = Amphiarthrosis
(D) = Diarthrosis

This would be a really good chart to know for the exam!

Shoulder (Glenohumeral) Joint

- ball-and-socket
- head of humerus
- glenoid cavity of scapula
- loose joint capsule
- bursae
- ligaments prevent displacement
  - very wide range of movement (but not as stable as hip)

Aka: humeroscapular joint
Shoulder Joint

- Acromioclavicular ligament
- Coracohumeral ligament
- Transverse humeral ligament
- Clavicle
- Acromion process
- Coracoid process
- Subscapular bursa
- Acromion process capsule
- Glenoid-labrum
- Scapula
- Articular capsule (glenohumeral ligaments hidden)
- Humerus
- Glenohumeral ligaments (b)

Rotor Cuff

- Rotator cuff muscles = the SITS muscles
- Acromioclavicular ligament
- Coracoacromial ligament
- Tendon of biceps brachii muscle
- Subscapularis bursa
- Tendon of infraspinatus muscle
- Articular capsule
- Teres minor muscle
- Glenoid labrum
- Humeroulnar ligament
- Radioulnar ligament (annular lig.)
- Radioulnar joint (annular lig.)
- Glenohumeral ligaments
- Lateral view of shoulder joint, humerus removed

Elbow Joint

- Hinge joint (1)
  - Trochlea of humerus
  - Trochlear notch of ulna
  - Humeroradial joint
- Gliding joint (2)
  - Capitalum of humerus
  - Head of radius
  - Humeroradial joint
  - Radioulnar joint (annular lig.)
- Flexion and extension
- Many reinforcing ligaments
- Stable joint

Which arm, and which view, are we looking at here?
Elbow Joint

- Humerus
- Medial epicondyle
- Lateral epicondyle
- Ulnar collateral ligament
- Olecranon process
- Radial collateral ligament

Hip (Coxal) Joint

- Ball-and-socket joint
- Head of femur
- Acetabulum
- Heavy joint capsule
- Many reinforcing ligaments
- Less freedom of movement than shoulder joint, but very strong

- Fovea capitis and ligamentum capitis (teres)

Hip Joint

- Pubofemoral ligament
- Iliofemoral ligament
- Ischiofemoral ligament
- Greater trochanter
- Lesser trochanter
- Femur
- Ilium

Figure from: Hole’s Human A&P, 12th edition, 2010
Figure from: Saladin, Anatomy & Physiology, McGraw Hill, 2007
Knee (Tibiofemoral) Joint

- largest, most complex joint
- medial and lateral condyles of distal end of femur
- medial and lateral condyles of proximal end of tibia
- femur articulates anteriorly with patella (patellofemoral joint)
- modified hinge joint
- flexion/extension/little rotation
- strengthened by many ligaments and tendons
- menisci (fibrocartilage discs) separate femur and tibia
- bursae

Figure from Hole’s Human A&P, 12th edition, 2010

Knee Joint

Deep posterior view, extended

Figure from Martini, Anatomy & Physiology, Prentice Hall, 2001

Knee Joint

Figure from Martini, Anatomy & Physiology, Prentice Hall, 2001


(Meniscus = crescent)
Life-Span Changes

- Joint stiffness is an early sign of aging
- Regular exercise can prevent stiffness
- Changes in symphysis joints of vertebral column diminish flexibility and decrease height
- Synovial joints lose elasticity

Clinical Application – Joint Disorders

Sprains
- damage to cartilage, ligaments, or tendons associated with joints
- forceful twisting of joint

Bursitis
- inflammation of a bursa
- overuse of a joint

Arthritis
- inflamed, swollen, painful joints
  - Rheumatoid Arthritis (RA)
  - Osteoarthritis (OA)
  - Gout
Rheumatoid Arthritis (RA)

Result of autoimmune attack on the joints


Joint Prostheses

Prostheses used in knee replacement


Be sure to check out the ExRx Articulations link on the Web site to get familiar with joint movements.