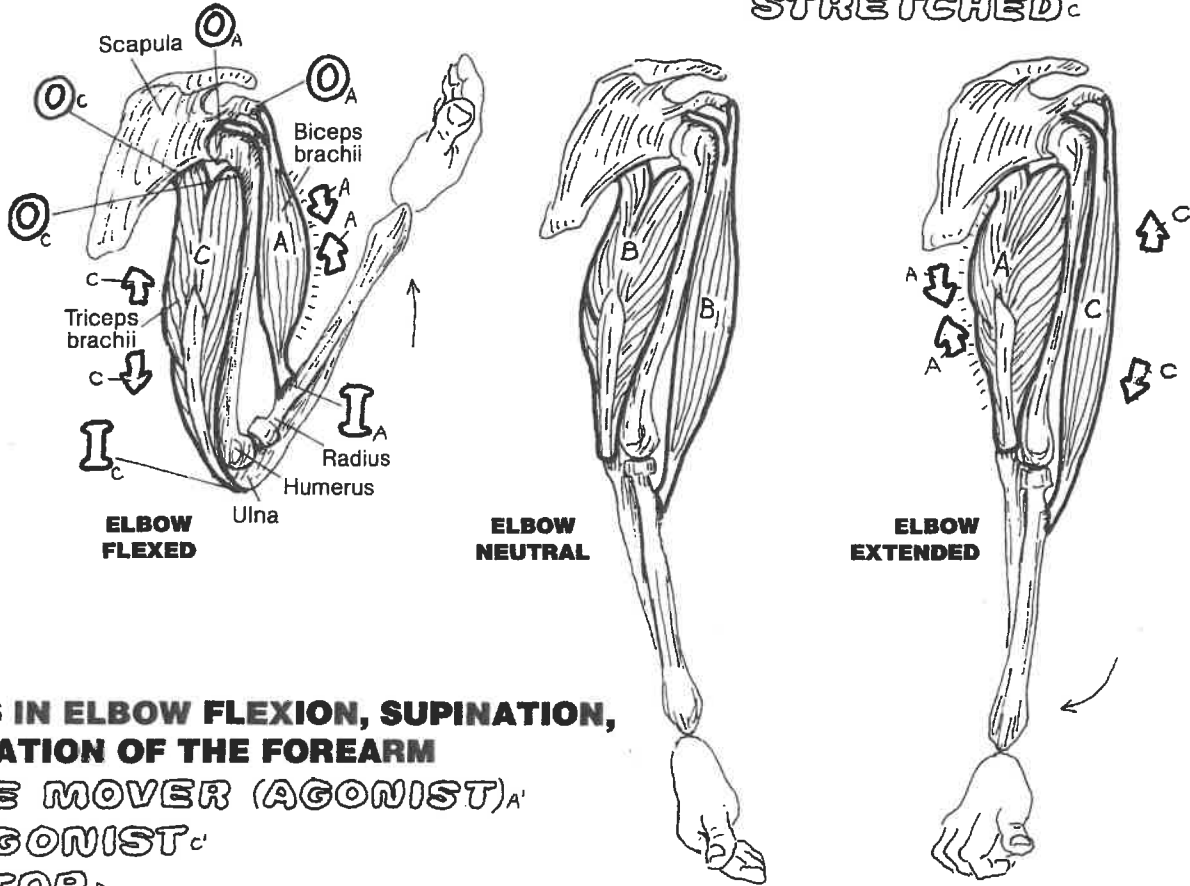


MUSCULAR SYSTEM INTEGRATION OF MUSCLE ACTION

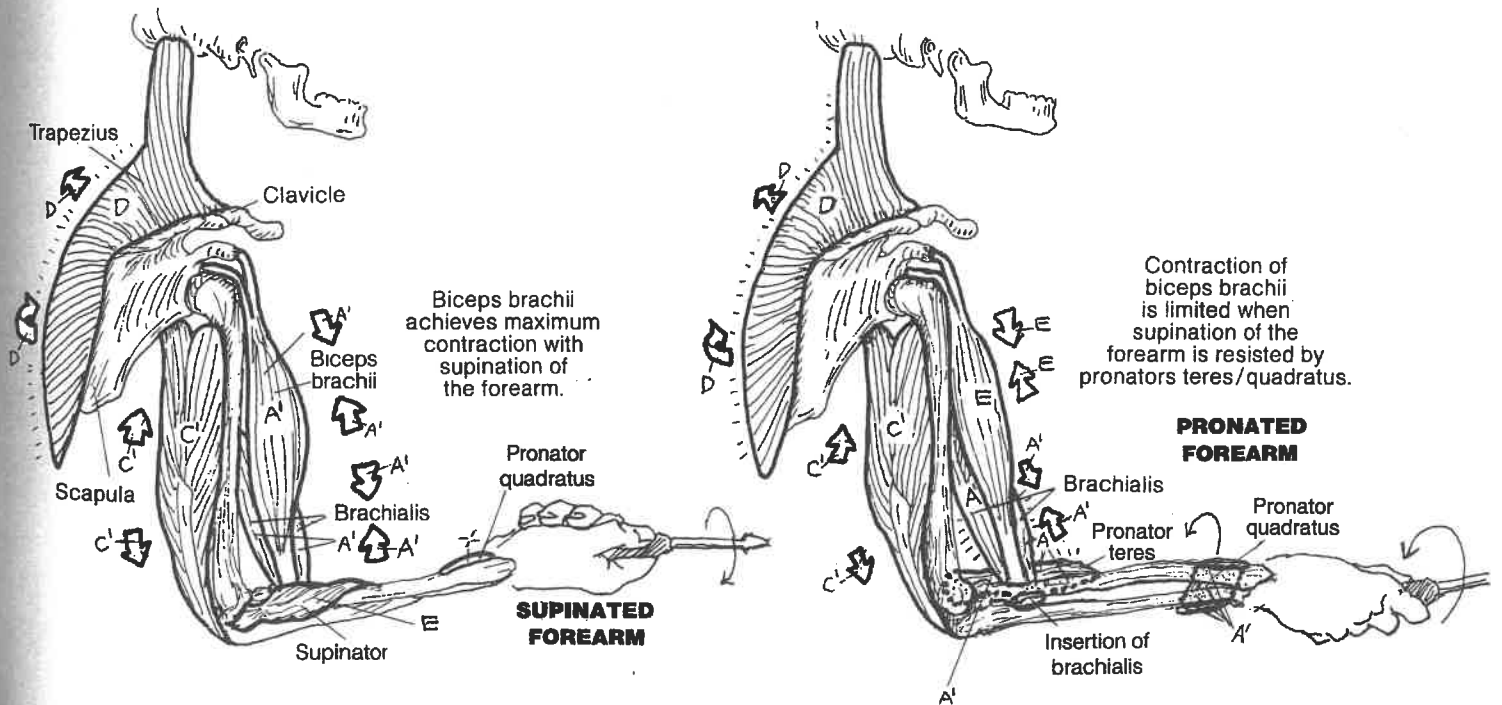
CN: (1) Color the names at upper right, and relate them to the small arrows A and C, the large outline letters O and I, and the flexor and extensor muscles of the elbow joint. Note the directions of the arrows. Color left to right. The relaxed muscles of a neutral elbow have a degree of tension (tone) even though they are relaxed. (2) Color the muscle actor names A¹ to E relating to supination and pronation of the forearm and apply those colors to the muscles in the two lower illustrations.

MUSCLE ACTION
CONTRACTED A
RELAXED B
STRETCHED C



ACTORS IN ELBOW FLEXION, SUPINATION, & PRONATION OF THE FOREARM

PRIME MOVER (AGONIST) A¹
ANTAGONIST C¹
FIXATOR D¹
SYNERGIST E



INTEGRATION OF MUSCLE ACTION

Here we investigate the simple case of flexing the elbow joint. The fixed (nonmoving) bone is the humerus; the moving bone is the radius. The muscle attachments at the fixed bone are the *origins* (O) of the muscles (biceps, triceps). The attachments at the moving bone are the *insertions* (I) of those muscles. Here, biceps is the **agonist (prime mover)** and triceps is the **antagonist** for the action of elbow flexion. Starting at a neutral position (center), contraction of the biceps brachii brings the hand closer to the shoulder. At the same time, the muscle triceps brachii stretches with some resistance (contraction) to accommodate the desired movement. With both sets of muscles at rest, the limb is said to be "neutral." In this situation, both biceps and triceps are relaxed with a mild degree of background muscle tone. Conversely, in elbow extension, the agonist shortens while the antagonist is **stretched**.

In summary, the prime mover is the primary muscle effecting a desired joint movement. Secondary movers in such a joint movement may be called **synergists**. Synergists often act as neutralizers, assisting intended movements or resisting unintended movements. Muscles opposing a prime mover's action are antagonists. **Fixators** serve to "fix" more proximal muscles to stabilize the background conditions for a specific joint movement, as trapezius is doing in the action at lower left and right. Agonists, synergists, antagonists, and fixators often work together to move a limb into a desired position (integration of muscle action).

ELBOW FLEXION, SUPINATION, & PRONATION OF THE FOREARM

Here we focus on four muscles that act on the right elbow joint and the proximal and distal radioulnar joints of a right-handed person in the act of holding up the right hand gripping a screwdriver and driving a screw clockwise into the frame of a door. In the first case (lower left illustration), the forearm is repeatedly supinated (and repeatedly pronated to return the forearm to a new starting point for each act of supination) as the screw is driven into the wood. Here biceps is the prime mover and supinator is a synergist in this action of supination. This is so because the rotation of the radius during supination puts tension on the insertion of biceps brachii, inducing its contraction in the face of the desired action (supination). Biceps is stronger than supinator. Test this on yourself: as you supinate the forearm, feel biceps contract.

In the second case (lower right illustration) the forearm is pronated repeatedly which backs the screw out of the wood. Pronation of the forearm is the weaker of the two rotational actions. Contraction of biceps is limited when supination of the forearm is resisted by pronator teres and pronator quadratus. Try it. If pronation is the weaker action, isn't it possible one can't get the screw out? Nah...bring in the cordless impact driver, and click it in reverse.

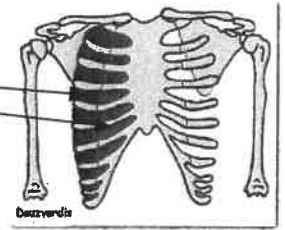
A. Sternocleidomastoid

Muscle action: _____



B. Intercostal Muscles (Internal and External):

Muscles Action: _____



C. Transversus Thoracis:

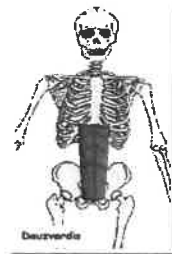
Muscle Action: _____



Muscles of Abdomen:

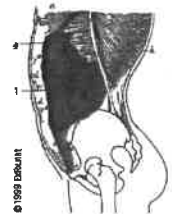
A. Rectus Abdominis:

Muscle Action: _____



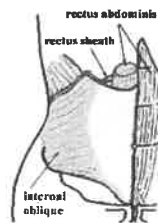
B. External Abdominal Oblique:

Muscle Action: _____



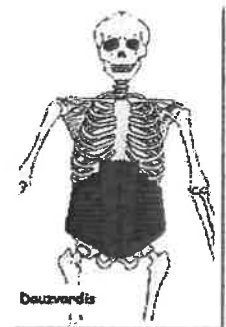
C. Internal Abdominal Oblique:

Muscle Action: _____



D. Transversus Abdominis:

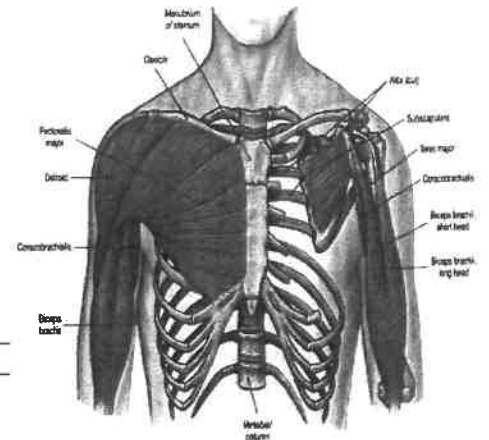
Muscle Action: _____



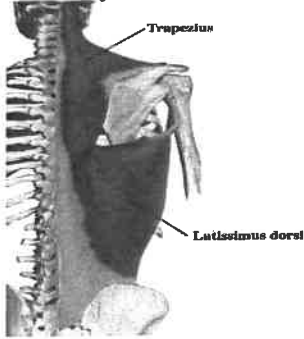
Muscles of the Pectoral Girdle:

A. Pectoralis Major

Muscle Action: _____



B. Latissimus Dorsi

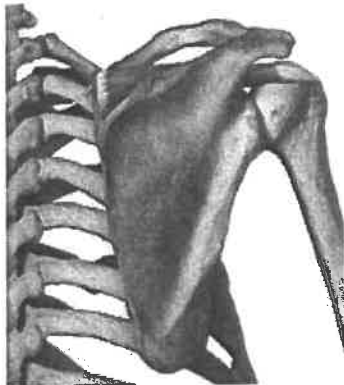


Muscle Action: _____

Muscles of the Rotator Cuff:

The rotator cuff consists of four muscles that essentially hold the shoulder joint in place.

A. Supraspinatus



Muscle Action: _____

B. Infraspinatus

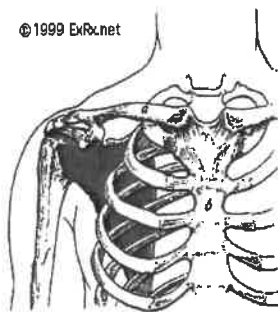


Muscle Action: _____

C. Teres Minor

Muscle Action: _____

D. Subscapularis



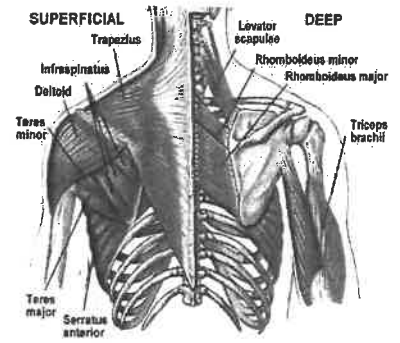
Muscle Action: _____

- The muscles that position the scapula and link it to the axial skeleton are:

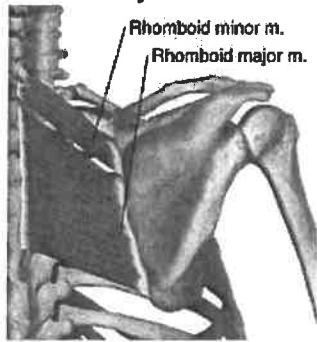
A. Trapezius



Muscle Action: _____



B. & C. Rhomboid Major and Minor



B. Rhomboid Major

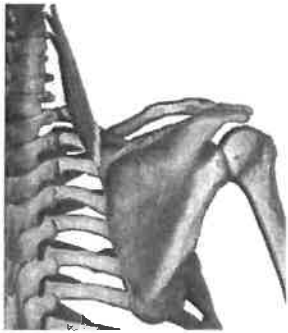
C.

Rhomboid Minor

Muscle Action: _____

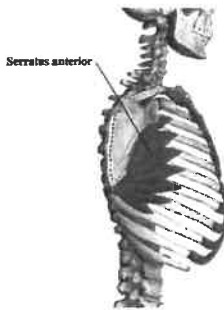
Muscle Action: _____

D. Levator Scapulae



Muscle Action: _____

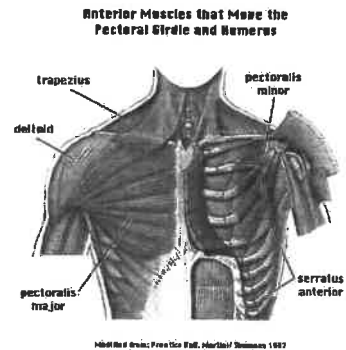
E. Serratus Anterior



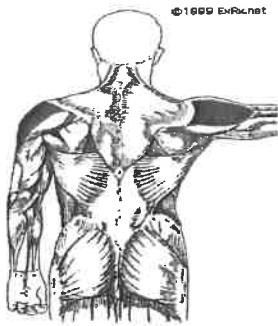
Muscle Action: _____

F. Pectoralis Minor

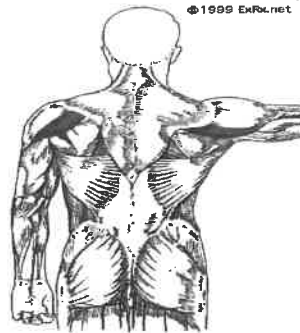
Muscle Action: _____



The Deltoid Group



Lateral



Posterior

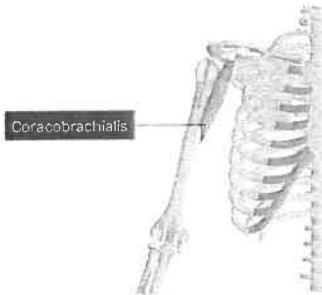


Anterior

A. The Deltoid group

Muscle Action: _____

B. Coracobrachialis

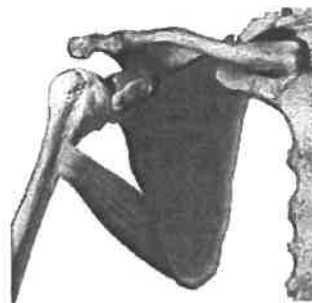


Muscle Action: _____

C. Teres Major



Posterior View



Anterior View

Muscle Action: _____

To review, and for the sake of having all of the aforementioned muscles visually on one page, here is a chart showing a list of muscles covered in Sports Medicine 15.

Muscles of the Upper Limbs (24 muscles)

Muscles of the Neck	Muscles of the Abdomen and Thoracic cage	Muscles of the Shoulder Complex
<p>Sternocleidomastoid</p>	<p>Intercostal muscles Transversus thoracis</p> <p>Rectus abdominus External obliques Internal obliques Transversus abdominis</p>	<p>Latissimus Dorsi Pectoralis Major</p> <p>Supraspinatus Infraspinatus Teres Minor Subscapularis</p> <p>Trapezius Rhomboid Major Rhomboid Minor Levator Scapulae Serratus Anterior Pectoralis Minor</p> <p>Lateral Deltoid Posterior Deltoid Anterior Deltoid Coracobrachialis Teres Major</p>