

The Biomechanics of Rowing

Key Components

There are four key components to the basic rowing stroke: *the catch*, *the drive*, *the finish*, and *the recovery*. The *catch* begins by grasping the handle evenly with both hands, with the seat slid forward so the knees are tucked into the chest and directly in line with the heel region of the foot. The arms are stretched out in front and the body is leaning slightly forward from the hips. To begin *the drive*, press firmly against the foot stretchers until the legs are almost fully extended, but not locked. Let the arms “go for the ride” as you slowly pull them toward the abdomen with the torso at a 90 degree angle with the monorail. In *the finish*, the arms are pulled all the way into the abdomen with the legs fully extended and your torso leaning back slightly beyond 90 degrees. For the *recovery*, extend the arms, bend your legs, and lean forward from the hips. As you do this, slide forward to start the next catch. The arms must pass over the knees before the knees bend. All four phases should be executed in a smooth, continuous, and fluid manner.

Biomechanics

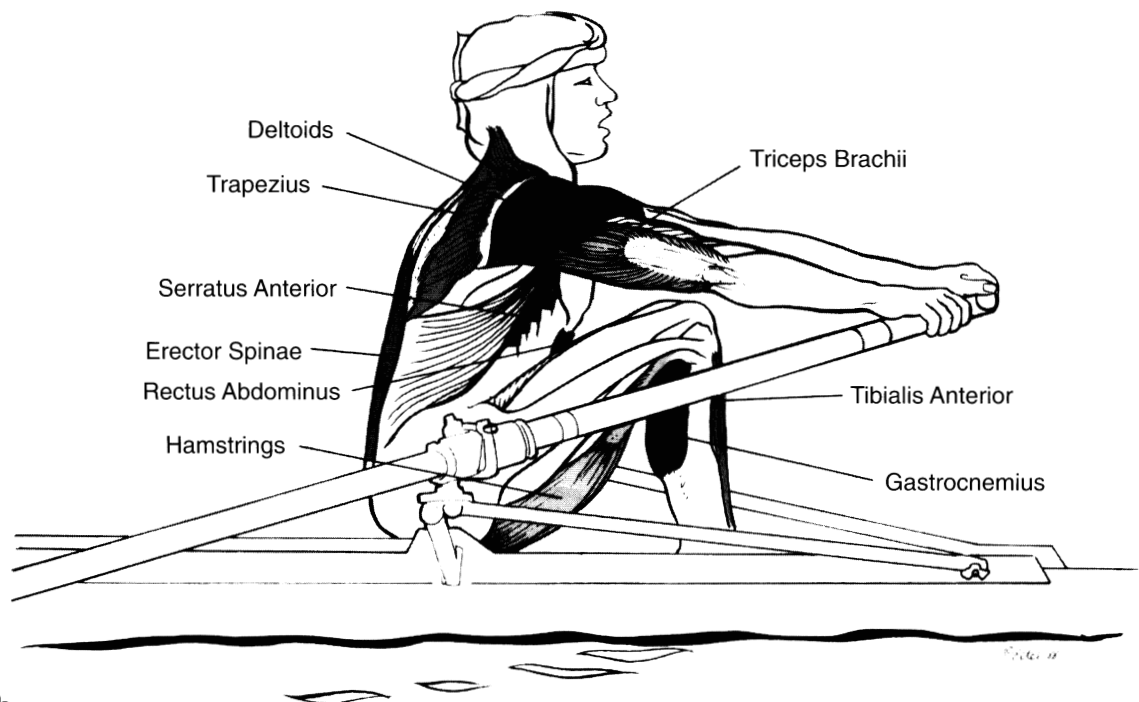
The basic rowing action is a coordinated muscle action that requires application of force in a repetitive, maximal, and smooth manner. Every large muscle group will contribute to this action. The muscle requirements have been analyzed by Dr. Thomas Mazzone.¹ The rowing action has been divided into the following sequence:

- 1) *the catch*
- 2) *the drive* - leg emphasis
- body swing emphasis
- arm pull through emphasis
- 3) *the finish*
- 4) *the recovery*

The Catch

The erector spinae muscles of the back are relaxed to allow for trunk flexion, which is provided by the abdominals. The psoas major and minor and the iliacus flex the pelvis and hips. The sartorius muscle rotates the thighs which allows the body to flex between the thighs to obtain maximum reach. The hamstrings and gastrocnemius are contracting while the knees are in flexion. The quadriceps are elongated and stretched, yet the rectus femoris is contributing to hip flexion. The ankles are dorsiflexed by the tibialis anterior.

The elbows are extended by the triceps brachii. The grip on the handle is accomplished by the flexor muscles of the fingers and thumb.



The Catch

1. *Kinesiology of the rowing stroke*, NSCA Journal, Volume 10, Number 2, 1988, Thomas Mazzone, M.D. Wyoming County Community Hospital, Warsaw, New York

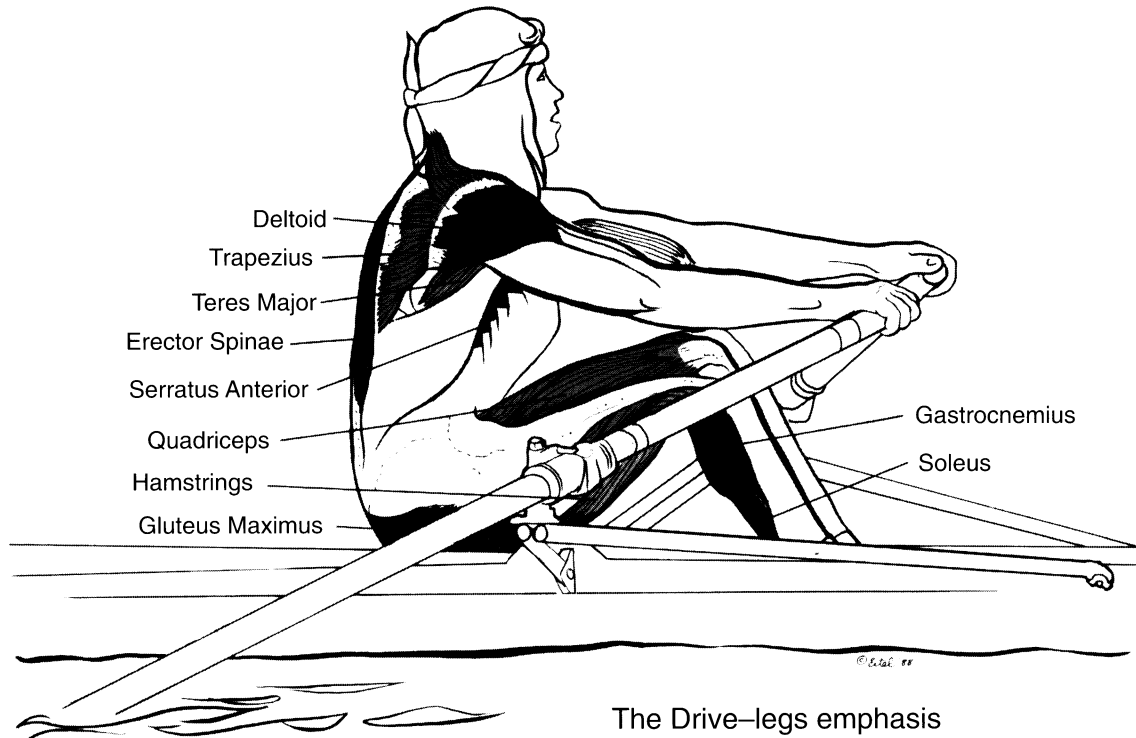
The Biomechanics of Rowing (continued)

The Drive

Legs Emphasis

The initial portion of the drive demands maximal power from the legs. The quadriceps extend the knee, and the feet are plantar flexed by the soleus and gastrocnemius muscles. A number of stabilizing muscles aid in supporting the lower back.

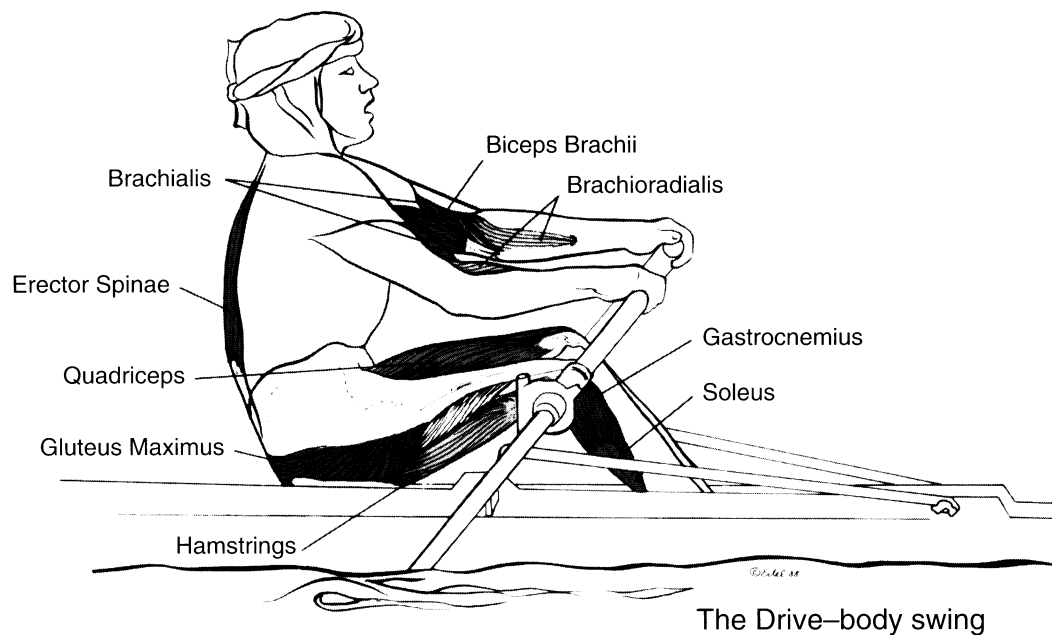
All the muscles of the shoulder are contracting. These include the supra and infraspinatus, subscapularis, teres major and minor, and the biceps brachii. The scapula is stabilized by the serratus anterior and trapezius muscles.



Body Swing Emphasis

As the knees are finishing their extension, the hip is also extending by the contraction of the gluteus and hamstring muscles. Back extension is occurring by contraction of the erector spinae.

In the upper body, elbow flexion is occurring via the biceps, brachialis, and the brachioradialis muscles.



The Biomechanics of Rowing (continued)

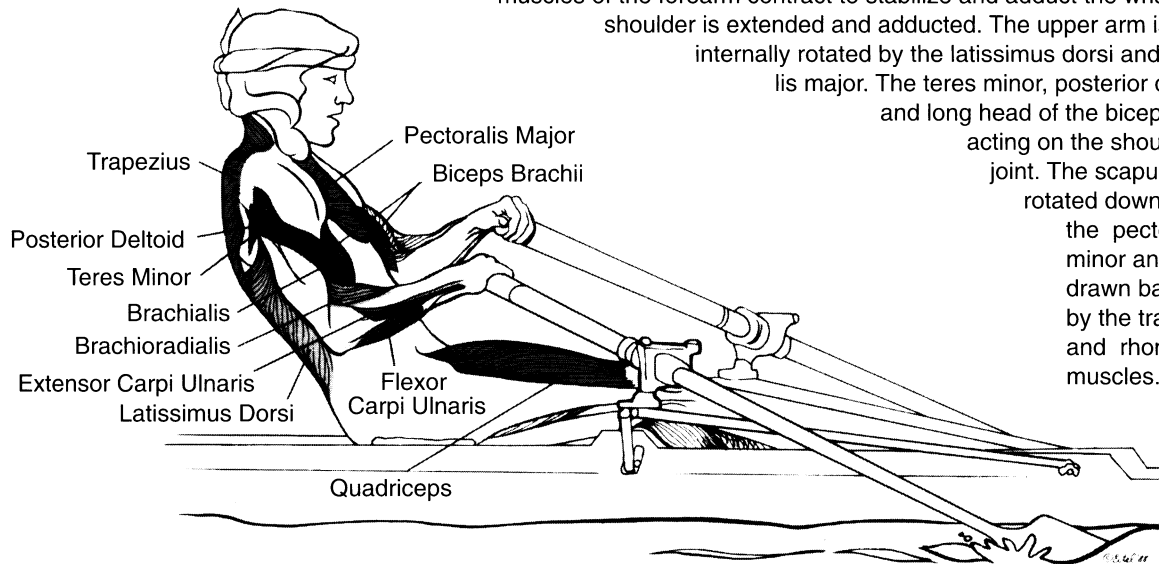
The Drive — Arm Pull Through

The knees are maximally extended, and the ankles are plantar flexed. In addition, hip and back extension are being completed. The upper body musculature is contracting with high force to finish the drive.

The elbow flexors are dominant. The flexor and extensor carpi ulnaris muscles of the forearm contract to stabilize and adduct the wrist. The shoulder is extended and adducted. The upper arm is

internally rotated by the latissimus dorsi and pectoralis major. The teres minor, posterior deltoid, and long head of the biceps are acting on the shoulder joint. The scapula is

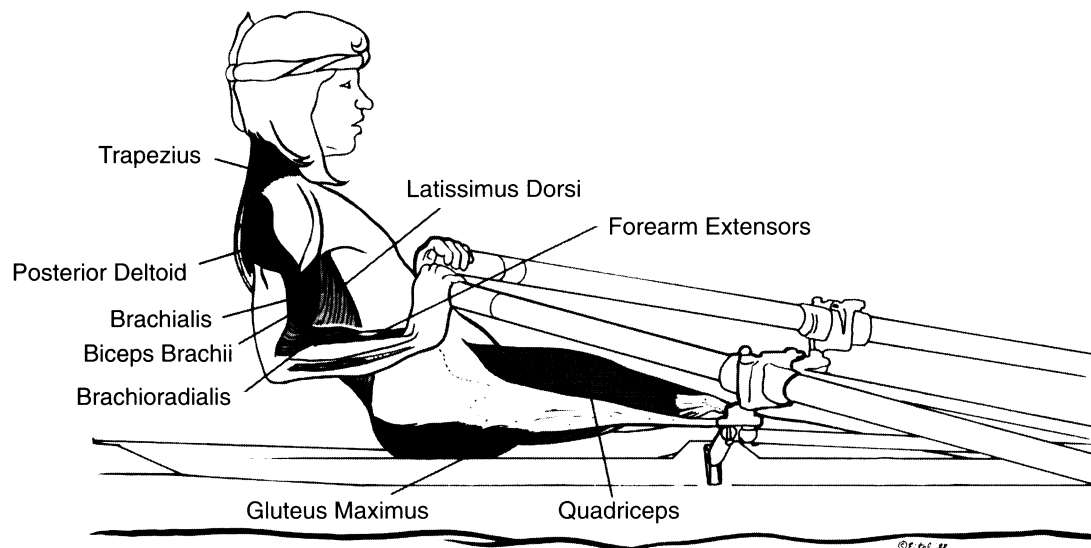
rotated downward by the pectoralis minor and then drawn backward by the trapezius and rhomboid muscles.



The Drive—Arm Pull Through

The Finish

The knees and ankles remain constant as the hips complete a full extension. The back extensors are continually contracting, and the upper arms are internally rotated by the contracting latissimus dorsi. The triceps are extending the elbows slightly.

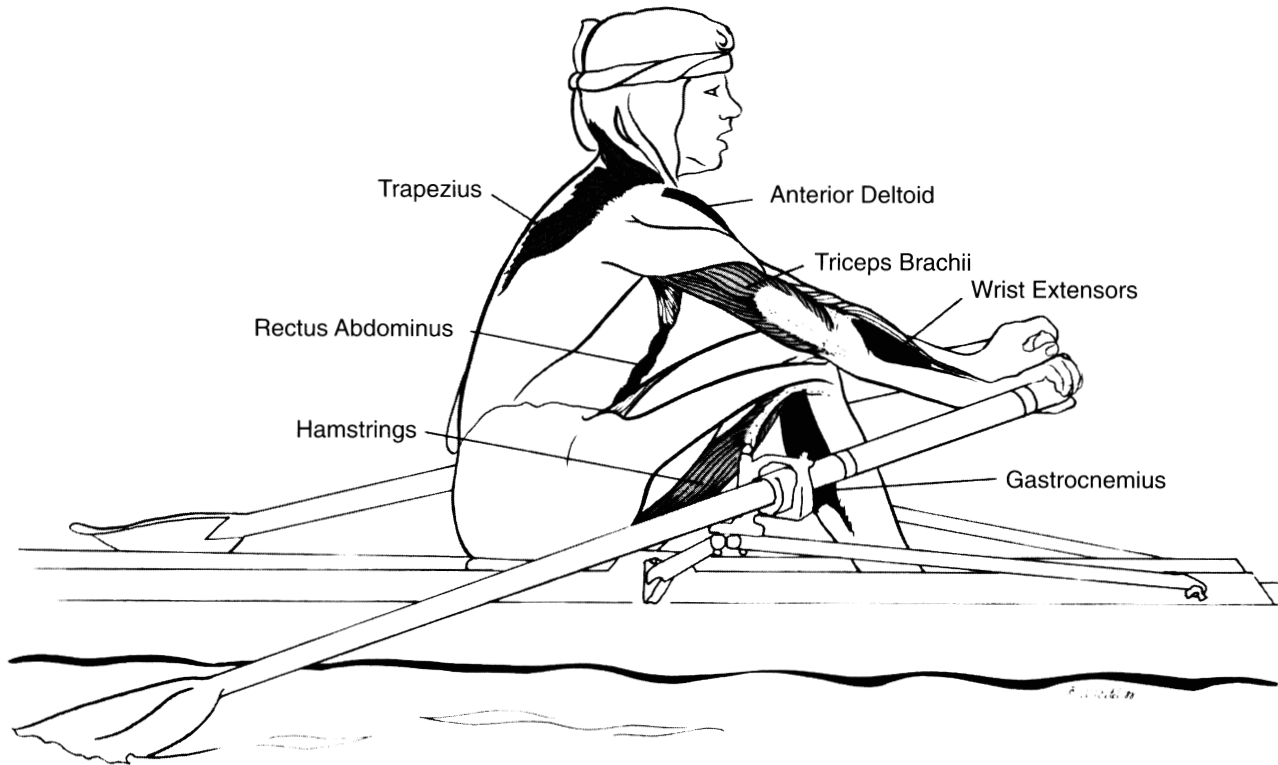


The Finish

The Biomechanics of Rowing (continued)

The Recovery

The arms are pushed forward and away from the body by the triceps until the elbows reach full extension. The anterior deltoids contract along with the coracobrachialis and biceps, and the upper arms raise slightly as they pass over the extended knees. The abdominals flex the torso, and once the hands have cleared the extended knees, the slide begins its forward motion through ankle dorsiflexion and hip and knee flexion.



The Recovery