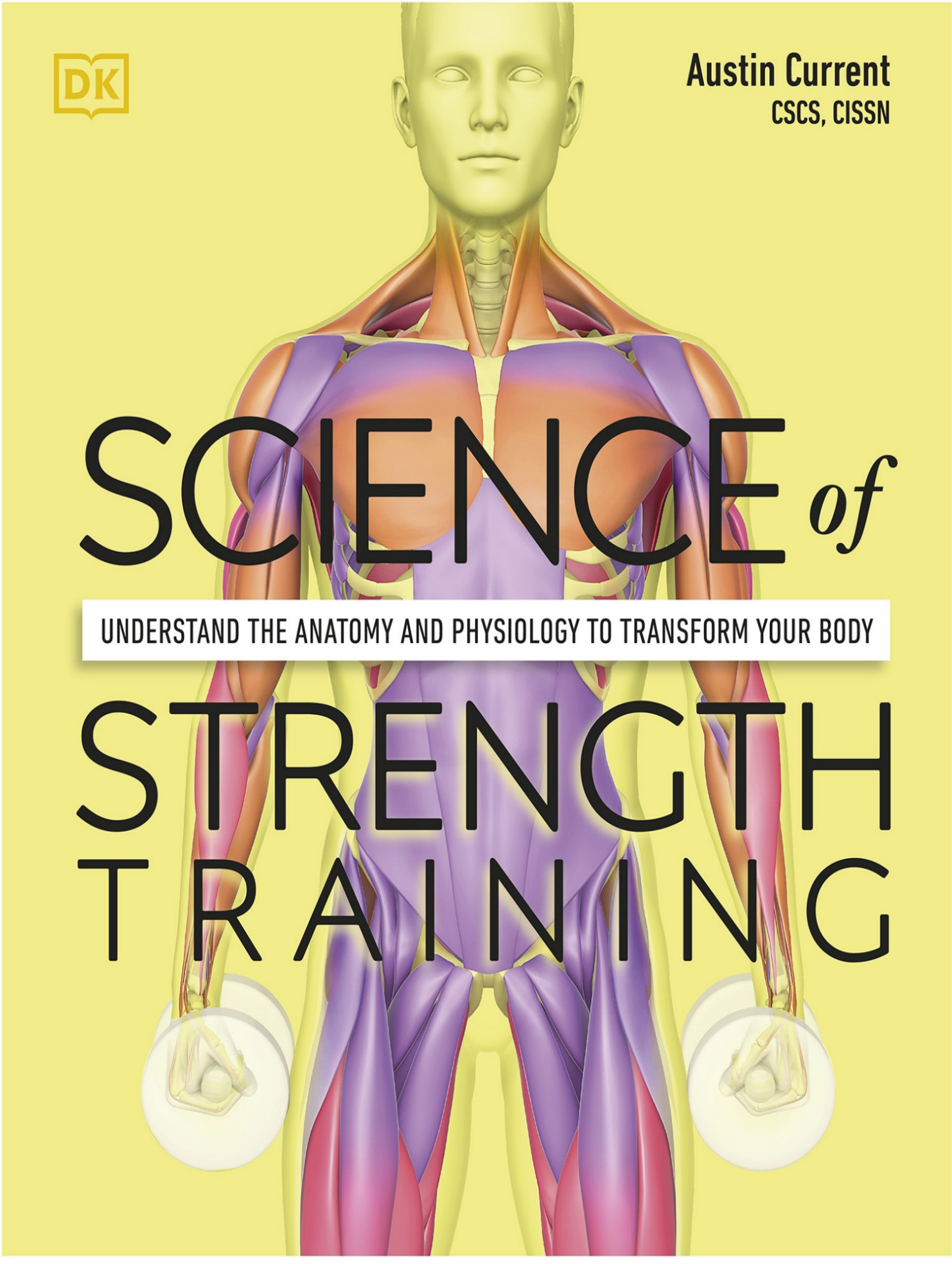


DK

Austin Current
CSCS, CISSN

SCIENCE *of* STRENGTH TRAINING

UNDERSTAND THE ANATOMY AND PHYSIOLOGY TO TRANSFORM YOUR BODY

DK

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INTRODUCTION

When it comes to strength training, also known as resistance training, knowledge is power. Most often, the largest barrier for participation in strength training is the complexity of resistance programmes or lack of knowledge in the gym. The aim of this book is to break down this barrier, teaching you the science behind strength training, how to perform exercises properly (at the gym or at home), and offering clear and simple programmes for beginners and those wanting to challenge themselves. Whatever your current level of knowledge or abilities, you'll find the information and tools you need to better learn, understand, and confidently perform strength training exercises – whether as a standalone activity or in combination with other forms of exercise.

THE BENEFITS OF STRENGTH TRAINING

The exercises in this book not only improve muscular strength and endurance, but also boost overall health. Incorporating strength training into your everyday life will bring with it a multitude of positive effects:

lowers the risk of a number of diseases, such as cardiovascular disease and type 2 diabetes

promotes muscle growth and retention, and counters the age-related reductions in muscle mass and muscle strength and in bone density across a lifespan

improves cognitive function, memory, and concentration

prevents age-related illness, such as Alzheimer's disease and dementia

lowers the risk and the severity of depression and anxiety.

HOW THE BOOK WORKS

The first section – human physiology – introduces you to the wonder that is skeletal muscle and the mechanisms that underpin strength training's demands on the body. It will help you understand how muscles work and grow, and how resistance work stimulates muscles to develop size and strength, alongside its positive impacts on bones and connective tissue. It also explains how the body powers muscular work and shows you how to calculate your own daily fuel and macronutrient requirements. Last, but by no means least, comes an overview of the benefits to the brain, and the crucial role it plays in attitude and mental health.

Much of the book is devoted to a comprehensive collection of strength exercises to perform, along with many variations offered to complement your available training equipment, personal preferences, and level of challenge. The exercises are organized according to which muscle group they target. Each displays the muscles being used throughout the movement with detailed instructions on how to achieve proper form and technique; common mistakes are covered, too.

The section on preventing injury explores common injuries related to resistance work, with explanations of how to avoid them and how to return to training if you do suffer an injury. A consistent and structured routine, including a proper warm-up, prepares the body for work and the various mobility exercises and stretches given will help you tune in to how your body is responding to the training.

The how to train section outlines everything you need to know about the variables of effective strength training, such as training volume and fatigue management. Whether you want to build muscle, strength, or endurance, you'll find an easy-to-follow programme to suit, as well as alternatives for those wanting to

work out more often. The programmes form the base for your training and can be adjusted in the months and years to come.



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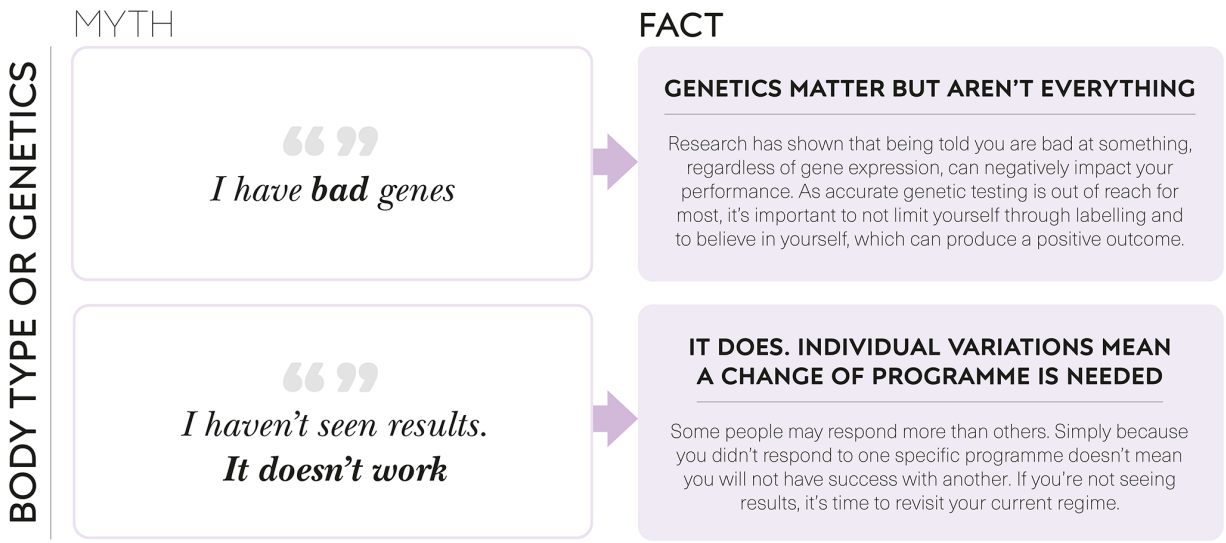
Fitness coach and educator

*“**Consistent strength training** improves **health** and **wellbeing** and **lowers the risk of disease** across a lifespan.”*

◀ CONTENTS

STRENGTH TRAINING FOR EVERYONE

We know now that everyone benefits from including strength training in their day-to-day lives. There is plenty of contradictory advice out there, but take a read through this debunking of common myths related to resistance work, and discover what body type you are and if that matters.

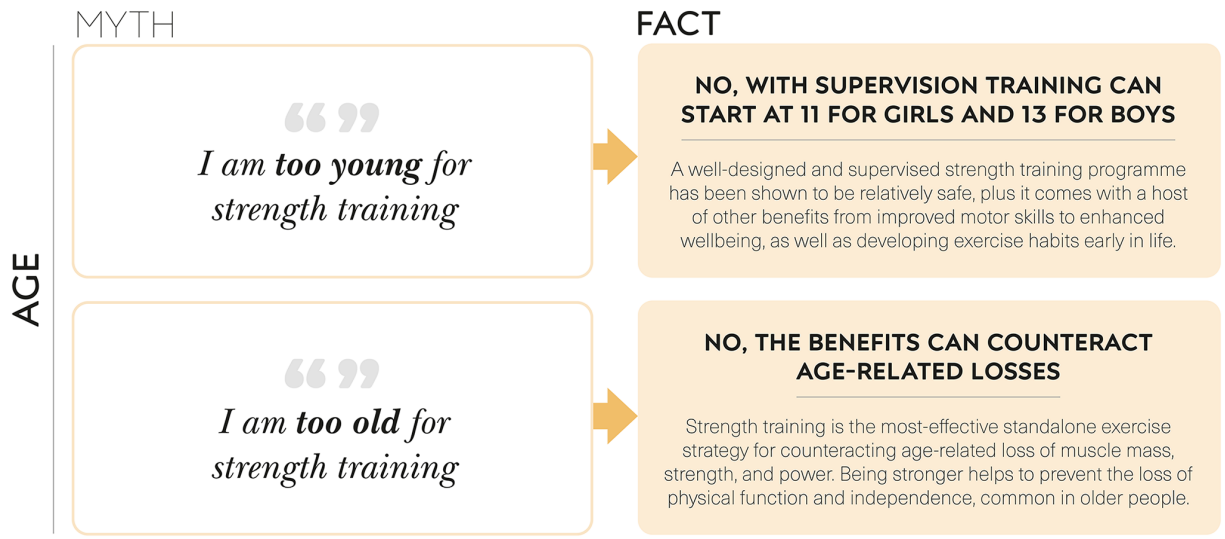


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BODY TYPE OR GENETICS

MYTH	FACT
“*I have **bad** genes*”	**GENETICS MATTER BUT AREN’T EVERYTHING** Research has shown that being told you are bad at something, regardless of gene expression, can negatively impact your performance. As accurate genetic testing is out of reach for most, it’s important to not limit yourself through labelling and to believe in yourself, which can produce a positive outcome.

"I haven't seen results. ***It doesn't work****"*	**IT DOES. INDIVIDUAL VARIATIONS MEAN A CHANGE OF PROGRAMME IS NEEDED** Some people may respond more than others. Simply because you didn't respond to one specific programme doesn't mean you will not have success with another. If you're not seeing results, it's time to revisit your current regime (see Variables within strength training).



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AGE

MYTH	FACT
*“I am **too young** for strength training”*	**NO, WITH SUPERVISION TRAINING CAN START AT 11 FOR GIRLS AND 13 FOR BOYS** A well-designed and supervised strength training programme has been shown to be relatively safe, plus it comes with a host of other benefits from improved motor skills to enhanced wellbeing, as well as developing exercise habits early in life.

*"I am **too old** for strength training"*	**NO, THE BENEFITS CAN COUNTERACT AGE-RELATED LOSSES** Strength training is the most-effective standalone exercise strategy for counteracting age-related loss of muscle mass, strength, and power. Being stronger helps to prevent the loss of physical function and independence, common in older people.



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MEN VERSUS WOMEN

MYTH	FACT
*"Strength training is **only for men**"*	**EVERYONE CAN BENEFIT** The many benefits of resistance training (see Introduction) are universal across genders. It's the most effective way of reshaping your body, adding muscle, and losing fat in areas you want to improve. Women benefit just as much as men do from strength training, whatever their improvement goals are.

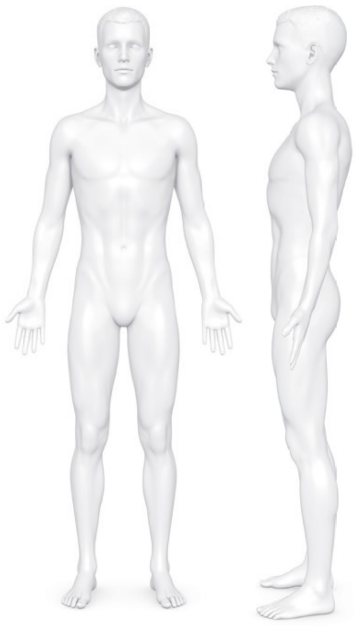
*"Strength training causes **women to get bulky**"*	**EXCESSIVE MUSCLE IS LIMITED BY OESTROGEN** A woman's ability to build excessive amounts of muscle tissue is limited by her natural hormones. Women have higher levels of oestrogen and lower levels of testosterone, which can help in recovery and in retention of muscle tissue.
*"Men grow **more muscle** than women"*	**EVERYONE EXPERIENCES SIMILAR LEVELS OF MUSCLE GROWTH** Men and women have been shown to experience similar levels of muscle growth with strength training, but importantly women start from a lower baseline. Men do experience more absolute gains due to their high levels of testosterone.

AM I LIMITED BY **BODY SHAPE?**

Your current body shape is not set for life; you can change and improve your physique through strength training. You may identify with one of the three body shapes (also known as somatotypes) now, but you shouldn't let your current body shape dictate your training recommendations. Managing stress, sleep, and nutrition as well as physical activity will all impact your body shape.

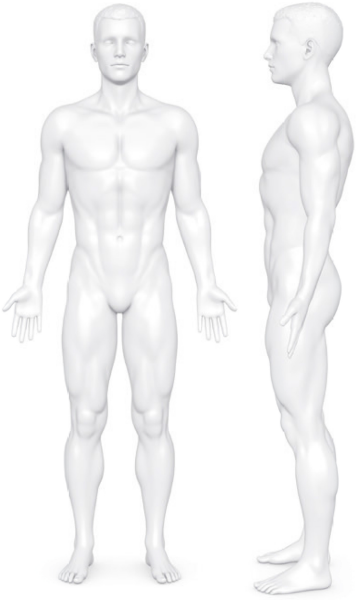
ECTOMORPH

Tall and leaner individuals who have a harder time building muscle but lose fat more easily.



MESOMORPH

Lean and muscular individuals who have an easy time building muscle and do not have a challenge losing body fat.

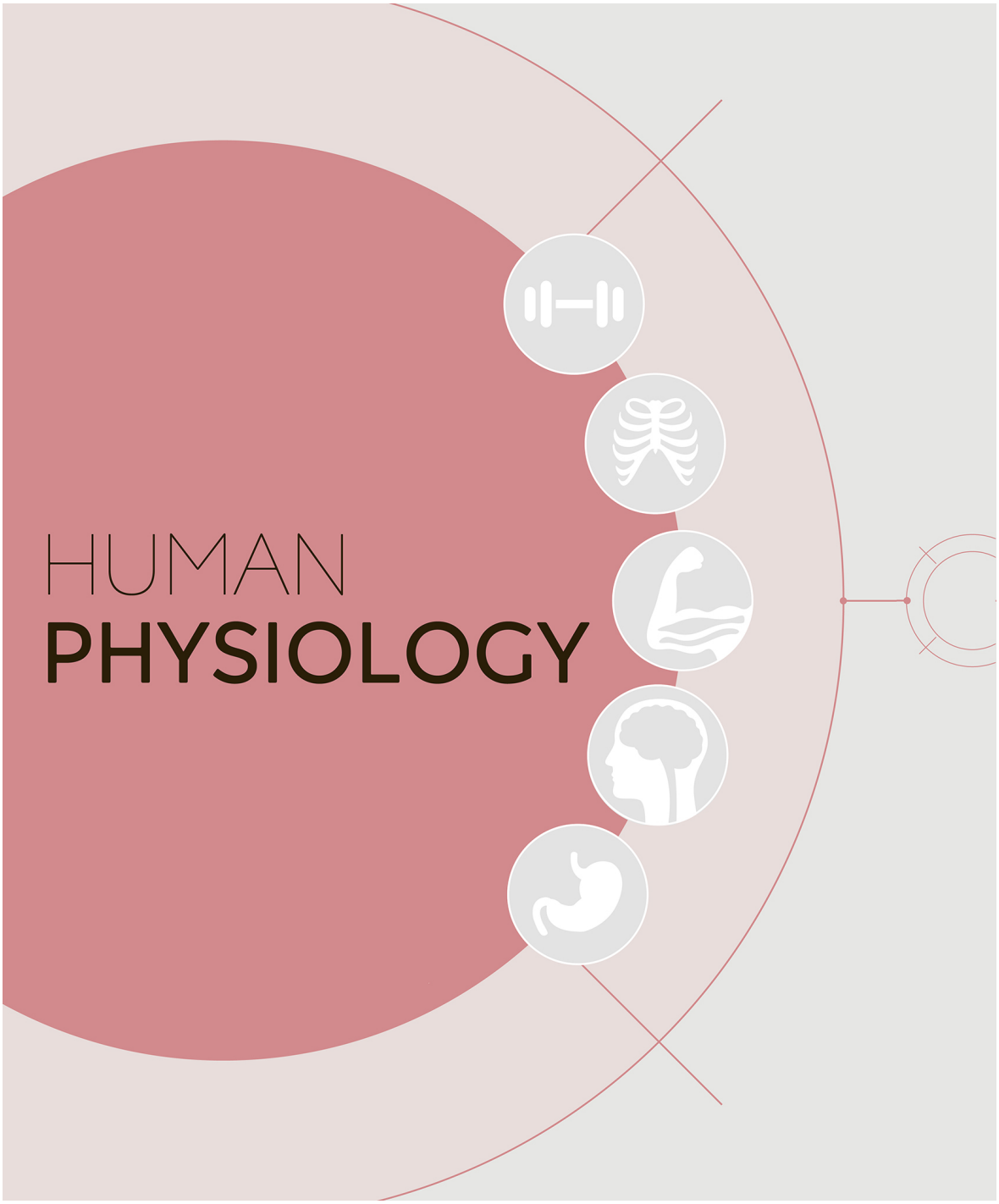


ENDOMORPH

Bulkier and larger individuals who have an easy time gaining muscle but a harder time losing body fat.



◀ CONTENTS



As well as building strength and muscle, strength training also has positive impacts on bone density and connective tissue, on the risk of metabolic disorders and cardiovascular diseases, and on psychology and mental health. Grow your understanding of how strength training affects the body and the nutrition it takes to maximize health, performance, and recovery.



MUSCULAR ANATOMY



HOW MUSCLES WORK



HOW MUSCLES GROW



HOW TRAINING PROMOTES MUSCLE GROWTH



HOW TRAINING PROMOTES BONE STRENGTH



THE MECHANICS OF MOVEMENT



POWERING MUSCLE ACTION



FUELS FOR STRENGTH TRAINING



DETERMINING YOUR ENERGY REQUIREMENTS



EATING FOR STRENGTH TRAINING



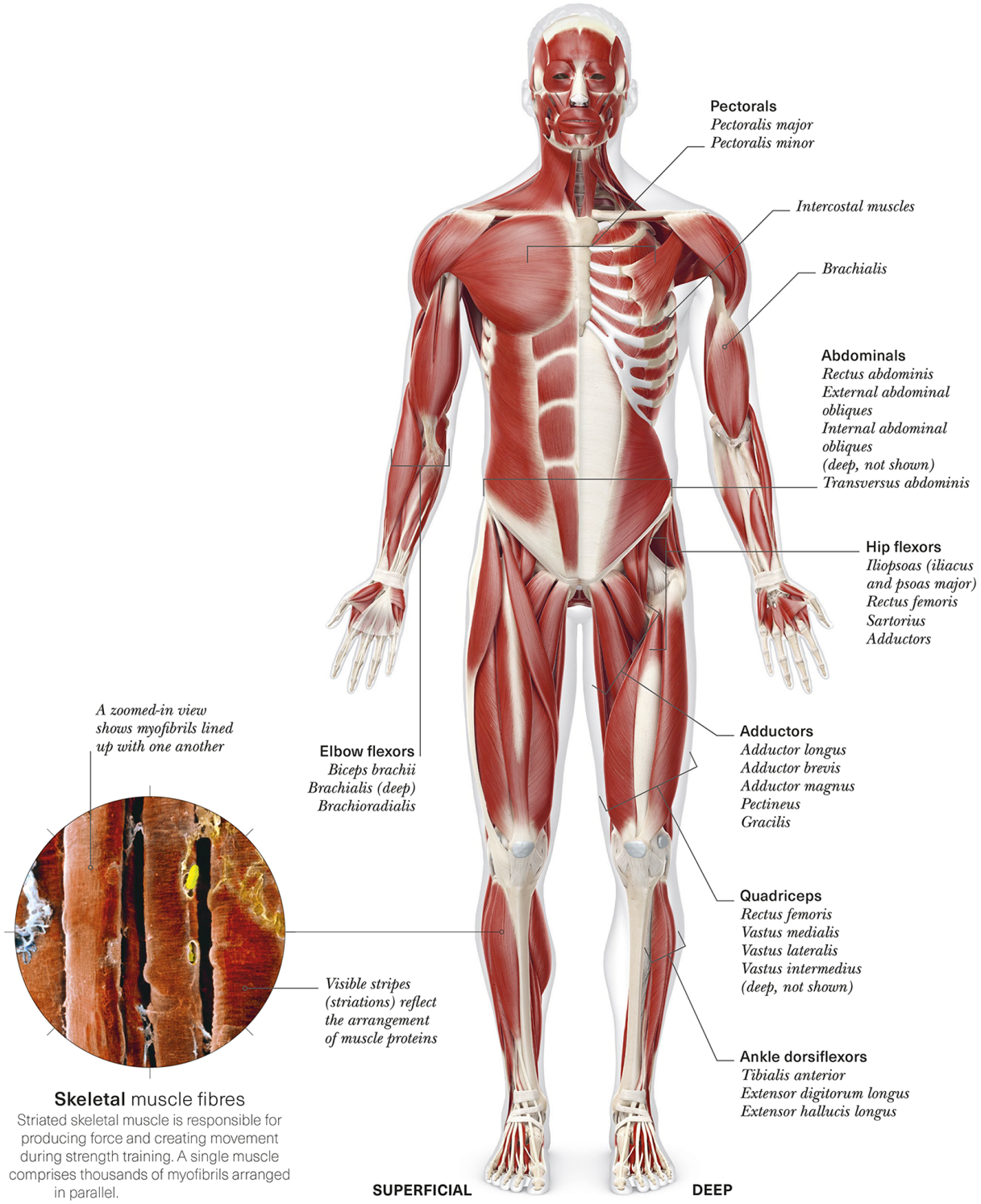
STRENGTH TRAINING AND YOUR BRAIN

MUSCULAR ANATOMY

There are over 600 muscles in your body – some deep inside your body, others more superficial. Skeletal muscles are attached to bones, via tendons, and facilitate movement.

SKELETAL MUSCLE

Muscle creates movement through coordinated contractions of skeletal muscle fibres. If you locate, study, and become familiar with the major muscle groups of your body, you can use this knowledge to visualize how the muscles function, as well as build greater mechanical tension during strength training exercises.



Skeletal muscle fibres

Striated skeletal muscle is responsible for producing force and creating movement during strength training. A single muscle comprises thousands of myofibrils arranged in parallel.

ℹ Double-tap image to read the labels

Skeletal muscle fibres

Striated skeletal muscle is responsible for producing force and creating movement during strength training. A single muscle comprises thousands of myofibrils arranged in parallel (see How Muscles Work).

SUPERFICIAL

Elbow flexors

Biceps brachii Brachialis (deep) Brachioradialis

Abdominals

Rectus abdominis
External abdominal obliques
Internal abdominal obliques (deep, not shown)
Transversus abdominis

DEEP

Pectorals

Pectoralis major
Pectoralis minor

Hip flexors

Iliopsoas (iliacus and psoas major)
Rectus femoris (see quadriceps)
Sartorius Adductors

Adductors

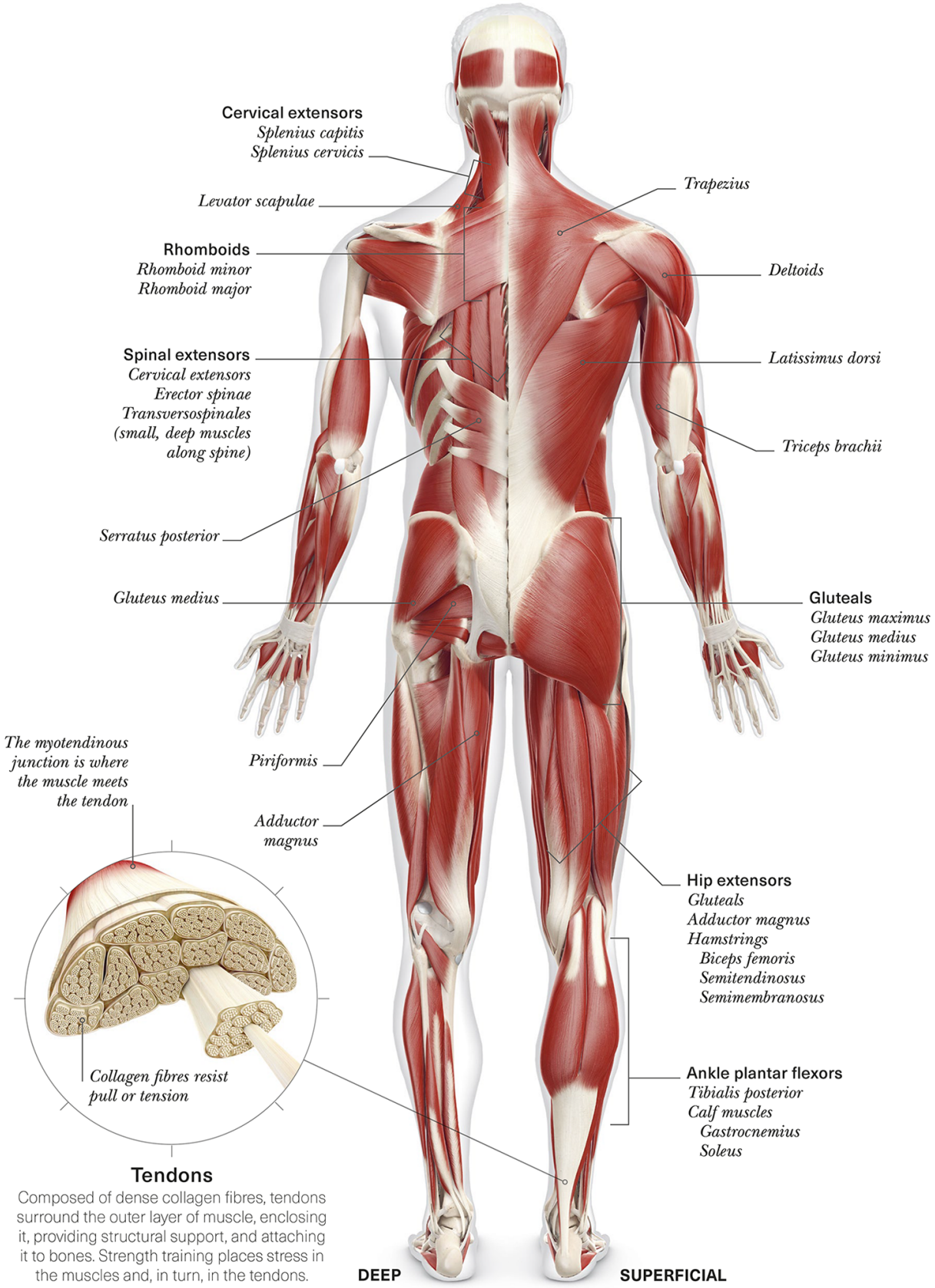
Adductor longus
Adductor brevis
Adductor magnus
Pectineus
Gracilis

Quadriceps

Rectus femoris
Vastus medialis
Vastus lateralis
Vastus intermedius (deep, not shown)

Ankle dorsiflexors

Tibialis anterior
Extensor digitorum longus
Extensor hallucis longus



Tendons

Composed of dense collagen fibres, tendons surround the outer layer of muscle, enclosing it, providing structural support, and attaching it to bones. Strength training places stress in the muscles and, in turn, in the tendons.

Double-tap image to read the labels

Tendons

Composed of dense collagen fibres, tendons surround the outer layer of muscle, enclosing it, providing structural support, and attaching it to bones. Strength training places stress in the muscles and, in turn, in the tendons.

DEEP

Cervical extensors

Splenius capitis
Splenius cervicis

Rhomboids

Rhomboid minor
Rhomboid major

Spinal extensors

Cervical extensors
Erector spinae
Transversospinales (small, deep muscles along spine)

SUPERFICIAL

Gluteals

Gluteus maximus
Gluteus medius
Gluteus minimus

Hip extensors

Gluteals

Adductor magnus

Hamstrings

- *Biceps femoris*
- *Semitendinosus*
- *Semimembranosus*

Ankle plantar flexors

Tibialis posterior

Calf muscles

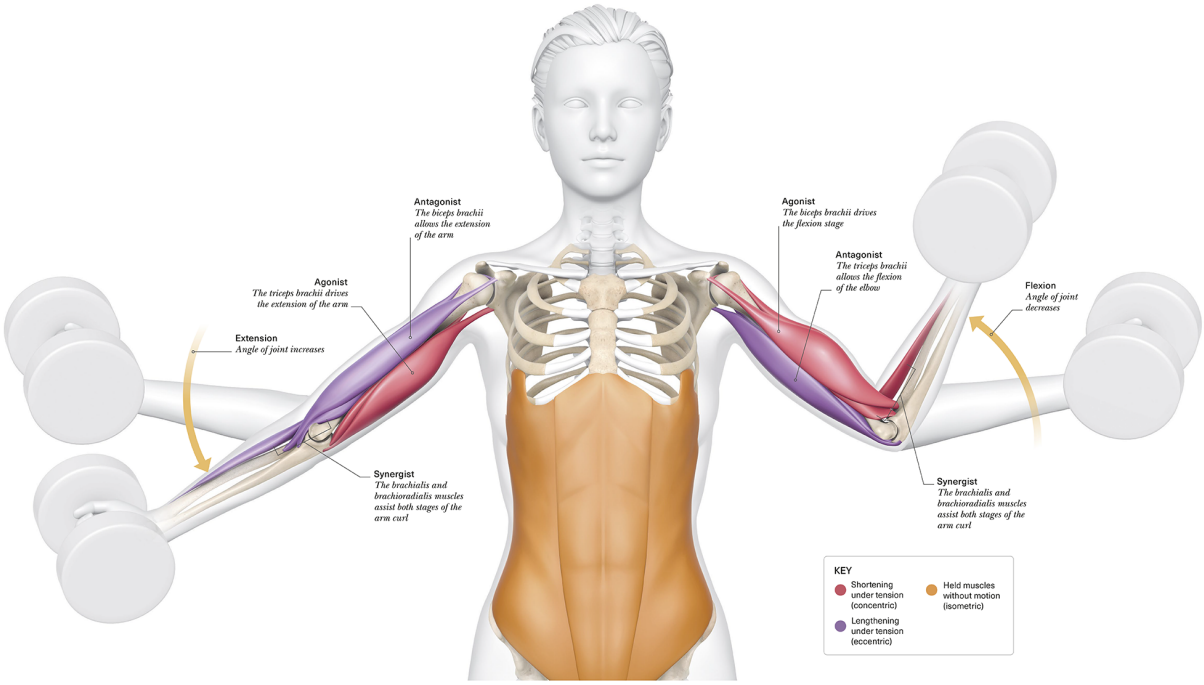
- *Gastrocnemius*
- *Soleus*

HOW MUSCLES WORK

Muscles are attached to bones via tendons, which can stretch to help deal with forces produced by movement. Muscles often work in antagonistic pairs to control the movement around a joint, such as the arm curl shown here. They can contract in various different ways.

TYPES OF CONTRACTION

In strength training, three types of contraction are referred to as isotonic – which is broken down into eccentric and concentric – and isometric. These names describe how a muscle is changing. For instance, isotonic involves a change in muscle length; eccentric contractions involve lengthening of a muscle while concentric involve shortening. In an isometric movement, a muscle is activated but doesn't cause any movement as there is no change in the muscle's length. (See How Training promotes muscle growth.)



Double-tap image to read the labels

ECCENTRIC CONTRACTION

During eccentric contraction, the muscle is lengthening and generating force. Eccentric contraction is stretching under tension that works to “brake” or decelerate movements. Here, the biceps brachii works eccentrically to “brake” the downward movement of the dumbbell.

Antagonist

The biceps brachii allows the extension of the arm

Agonist

The triceps brachii drives the extension of the arm

Synergist

The brachialis and brachioradialis muscles assist both stages of the arm curl

Extension

Angle of joint increases

CONCENTRIC CONTRACTION

During concentric contraction, a muscle creates tension while its muscle fibres shorten. As the muscle shortens, it generates enough force to move an object or weight. Here, the biceps brachii contracts concentrically to flex the elbow and lift the dumbbell.

Agonist

The biceps brachii drives the flexion stage

Antagonist

The triceps brachii allows the flexion of the elbow

Synergist

The brachialis and brachioradialis muscles assist both stages of the arm curl

Flexion

Angle of joint decreases

ISOMETRIC CONTRACTION

During isometric contraction, a muscle creates tension without any change in its length. Holding positions involve such contractions. For example, you engage abdominal muscles to stabilize your core, so you can focus on the target muscles of an exercise.

HOW MUSCLES **WORK TOGETHER**

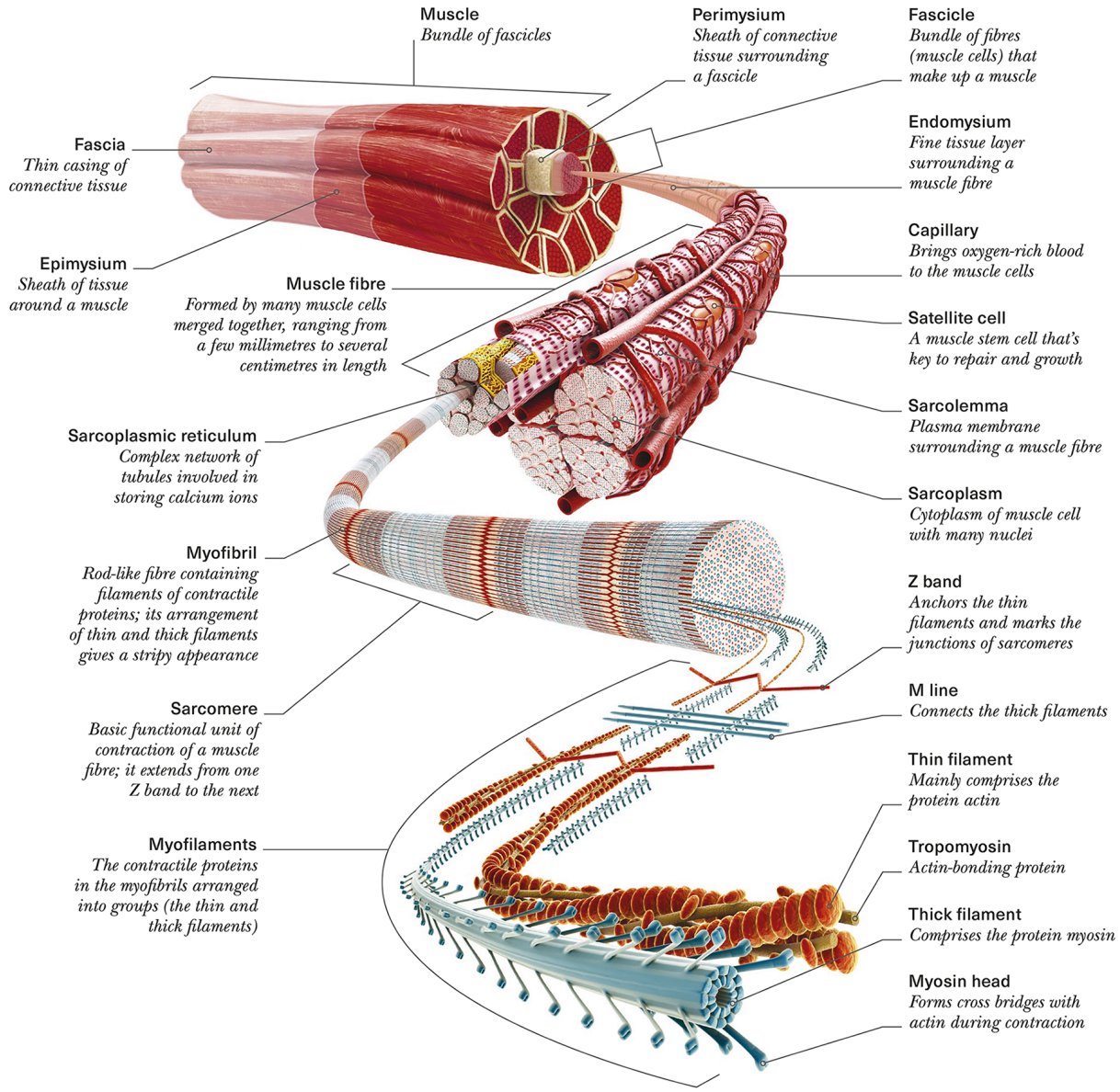
Muscles can only pull, they cannot push. To that end, they often work in antagonistic pairs. The prime mover, also known as the agonist, works alongside the synergist to create the joint motion. The antagonist, the muscle that opposes the prime mover, helps in controlling the movement on the other side of the joint.

Refining movements

When you first start performing strength training exercises, your nervous system tries to activate both agonist and antagonist at the same time, which results in “choppy” and less-coordinated movements. Over time and with practice, your nervous system adapts (see also Strength training and your brain) and coactivation is reduced in the antagonist muscle group, resulting in a smoother and more efficient joint action as well as more potential force production.

UNRAVELLING **A MUSCLE'S STRUCTURE**

Skeletal muscle comprises cylindrical bundles of muscle fibres known as fascicles. Each muscle fibre – also a muscle cell – is constructed from contractile protein filaments that produce muscle contraction. Each muscle also has a vascular network that transports oxygen and chemical substrates for energy production and removes waste generated by muscular contractions.



ℹ Double-tap image to read the labels

Muscle
Bundle of fascicles

Fascia
Thin casing of connective tissue

Epimysium
Sheath of tissue around a muscle

Perimysium
Sheath of connective tissue surrounding a fascicle

Fascicle
Bundle of fibres (muscle cells) that make up a muscle

Endomysium
Fine tissue layer surrounding a muscle fibre

Muscle fibre
Formed by many muscle cells merged together, ranging from a few millimetres to several centimetres in length

Capillary
Brings oxygen-rich blood to the muscle cells

Satellite cell
A muscle stem cell that's key to repair and growth

Sarcolemma
Plasma membrane surrounding a muscle fibre

Sarcoplasm
Cytoplasm of muscle cell with many nuclei

Sarcoplasmic reticulum
Complex network of tubules involved in storing calcium ions

Myofibril
Rod-like fibre containing filaments of contractile proteins; its arrangement of thin and thick filaments gives a stripy appearance

Sarcomere
Basic functional unit of contraction of a muscle fibre; it extends from one Z band to the next

Myofilaments
The contractile proteins in the myofibrils arranged into groups (the thin and thick filaments)

Z band
Anchors the thin filaments and marks the junctions of sarcomeres

M line
Connects the thick filaments

Thin filament
Mainly comprises the protein actin

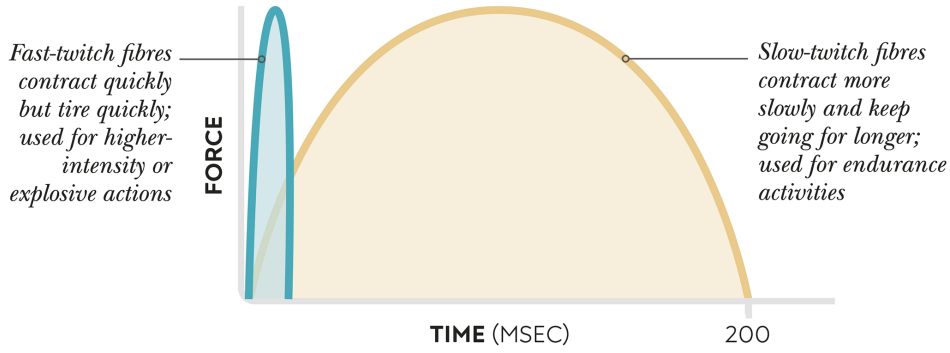
Tropomyosin
Actin-bonding protein

Thick filament
Comprises the protein myosin

Myosin head
Forms cross bridges with actin during contraction

Slow- and fast-twitch muscle fibres

There are two main types of skeletal muscle fibres – slow-twitch (or type 1) and fast-twitch (type 2). Your nervous system automatically chooses the right type of fibre for the given exercise. The majority of skeletal muscles have a fairly even split of both types of fibre, allowing for the ability to perform a variety of tasks of different magnitudes and durations.

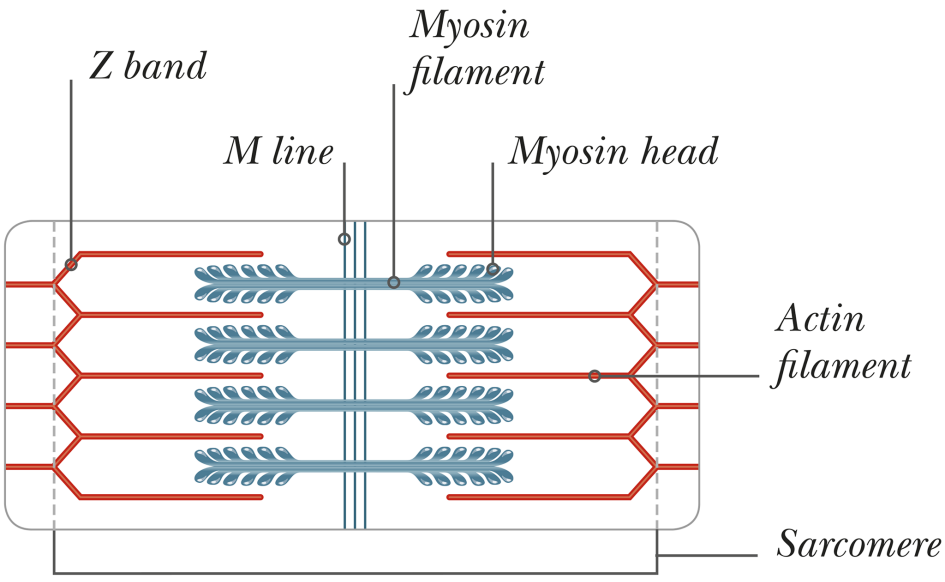


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HOW SLOW- AND FAST-TWITCH MUSCLES COMPARE

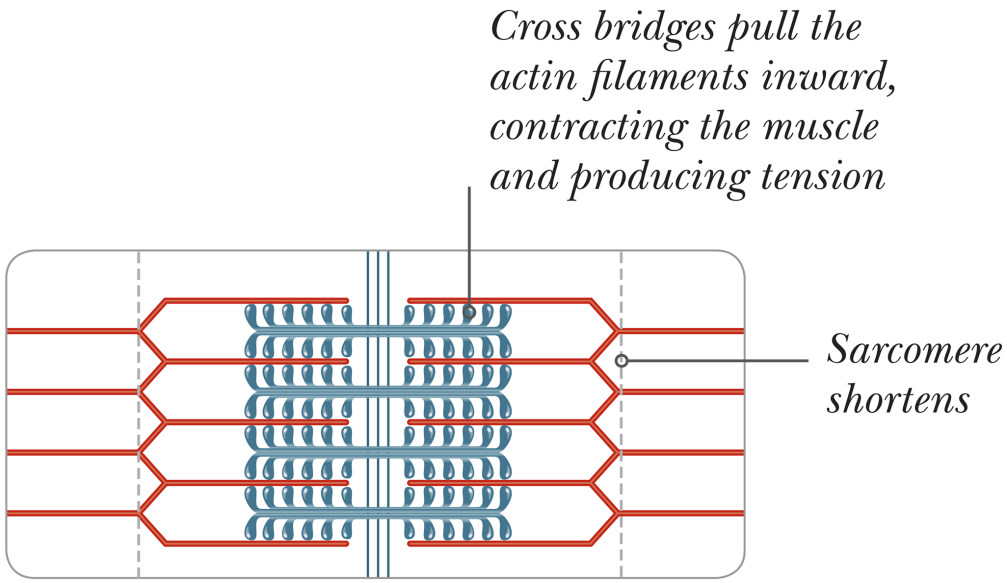
Muscle contraction at the microscopic level

The shortening and lengthening of skeletal muscle is achieved by contractile protein filaments in the myofibril – actin and myosin. A nervous impulse triggers a cycle of events within the muscle fibre. The filaments of actin and myosin attach, bend, detach, and then reattach through a repeated sequence to pull the actin filaments towards the centre of the sarcomere, creating tension within a muscle.



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RELAXED MUSCLE



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CONTRACTED MUSCLE

THE CYCLE OF CONTRACTION

ATTACHMENT

The activated myosin head attaches to binding site on the actin filament, forming what's known as a cross bridge between the filaments.

POWER STROKE

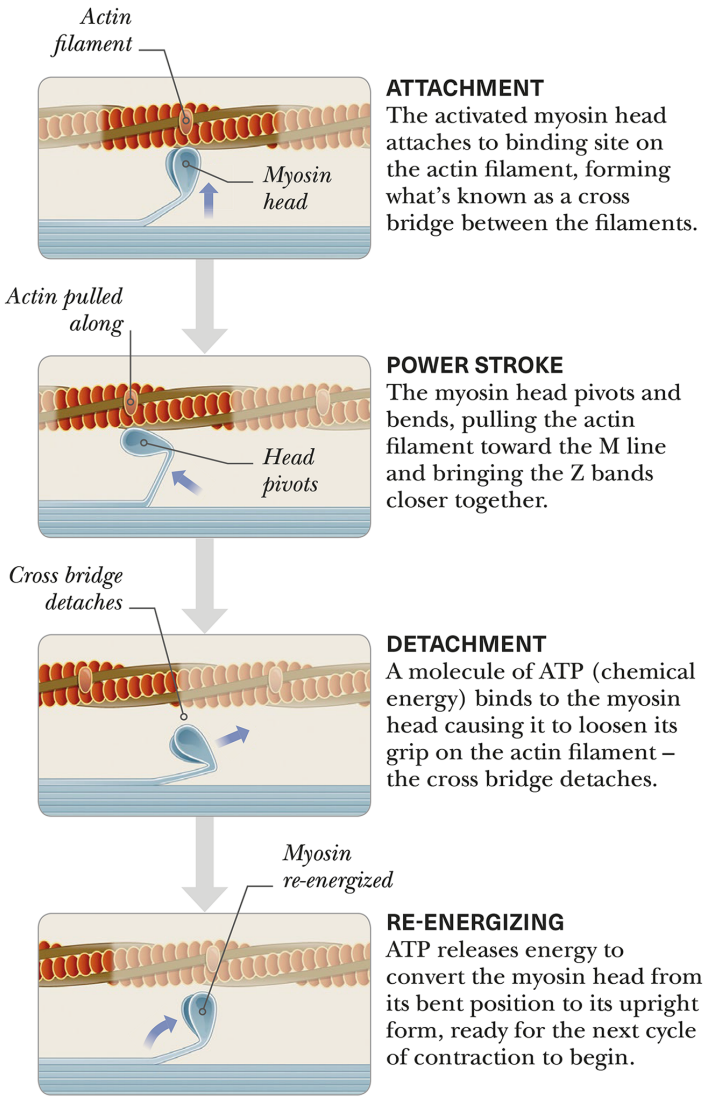
The myosin head pivots and bends, pulling the actin filament toward the M line and bringing the Z bands closer together.

DETACHMENT

A molecule of ATP (chemical energy) binds to the myosin head causing it to loosen its grip on the actin filament – the cross bridge detaches.

RE-ENERGIZING

ATP releases energy to convert the myosin head from its bent position to its upright form, ready for the next cycle of contraction to begin.



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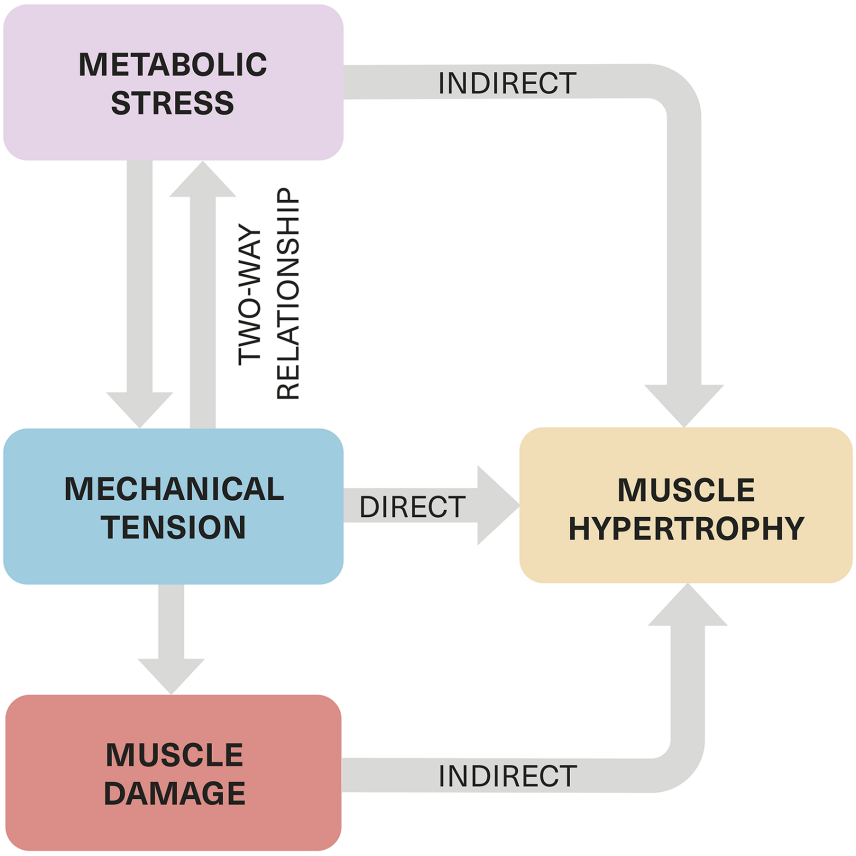
HOW MUSCLES GROW

Muscle cell growth – or muscle hypertrophy – can be generally defined as an increase in size of skeletal muscle tissue. Strength training stimulates muscle hypertrophy via various routes, and specialist cells maintain, repair, and grow new muscle.

STIMULI OF GROWTH

The current proposed understanding of what is occurring during the growth of skeletal muscle concerns three related stimuli: mechanical tension (the tension placed on a muscle fibre during strength training); metabolic stress (the accumulation of metabolic byproducts within the muscle fibre during training); and muscle damage (the micro-tears to the muscle fibre and disruption of the Z band).

The primary driver of muscle growth is mechanical tension. Fatigue, in part caused by the metabolic stress, raises mechanical tension, recruits more motor neurons to the muscle, and slows muscle fibre shortening. This combination of changes raises the number of muscles controlled, which accentuates the amount of mechanical tension produced. The resulting two-way relationship boosts tension further: metabolic stress is a byproduct of mechanical tension and also contributes to raising tension within a muscle.

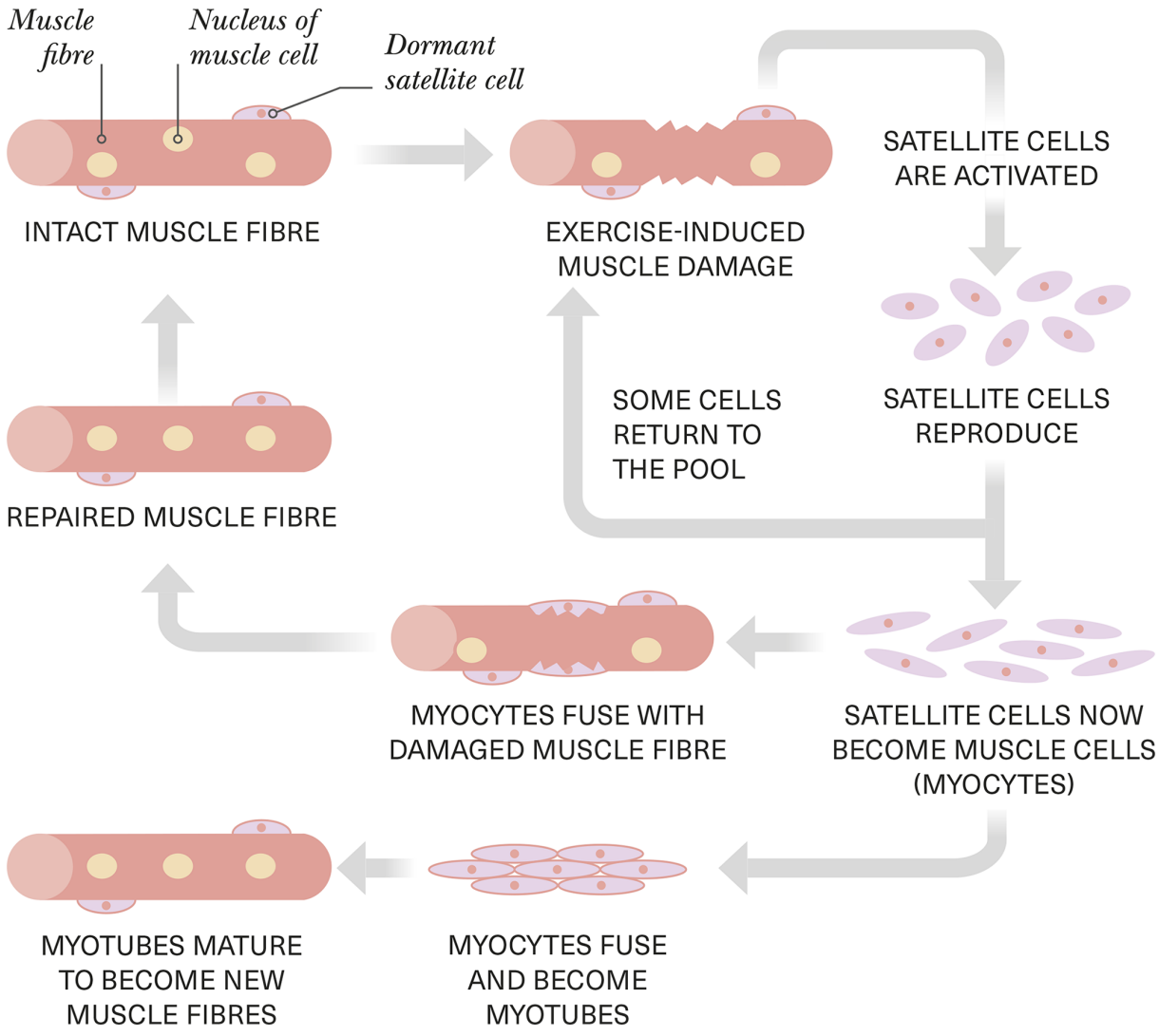


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MECHANISMS OF HYPERTROPHY

SATELLITE CELLS

Muscle satellite cells are a type of stem cell that plays a key role in the maintenance, repair (and growth), and remodelling of muscle fibres in response to exercise, especially strength training. Typically, they are dormant until needed. When stimulated, satellite cells can help to form new muscle fibres, help an existing muscle fibre by donating their nuclei, or they can return to replenish the pool of satellite cells.



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The decline of muscle mass with age

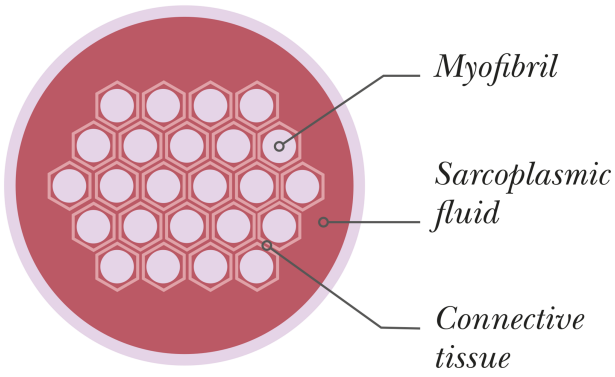
Muscle atrophy (the opposite of hypertrophy) is defined as the wasting or reduction in size of muscle tissue. Such a reduction in muscle is linked to poor quality of life and increased morbidity. After the age of 40, the body progressively loses muscle mass each year. However, consistent resistance training along with a good intake of protein (see Fuels for strength training) has been shown to reduce this progressive loss. The completion of physical activity, specifically strength training, can prevent and treat the conditions of sarcopenia (muscle loss) and dynapenia (loss of muscle strength and power).

HOW MUSCLES GET BIGGER

Skeletal muscle protein cycles through periods of synthesis and breakdown on a daily basis. Muscle growth occurs whenever the rate of muscle protein synthesis is greater than the rate of muscle protein breakdown. Muscle hypertrophy is thought to be a collection of adaptations to different components – the myofibrils, the sarcoplasmic fluid, and the connective tissue.

MUSCLE FIBRE BEFORE GROWTH

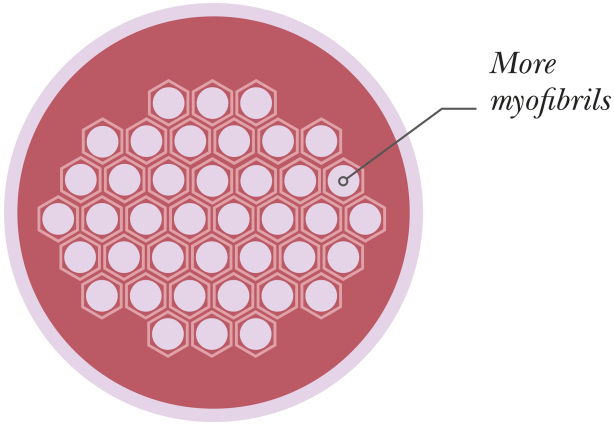
The circle represents a muscle fibre in cross-section. Within there are many myofibrils and surrounding them is sarcoplasmic fluid and a honeycomb-like layer of connective tissue.



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MYOFIBRILLAR HYPERTROPHY

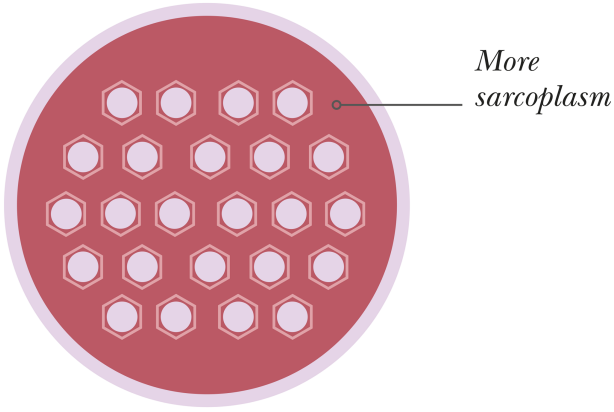
Myofibrillar protein makes up 60–70 per cent of the protein in a muscle cell. Myofibrillar hypertrophy is the increase in number and/or size of myofibrils by the addition of sarcomeres.



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SARCOPLASMIC HYPERTROPHY

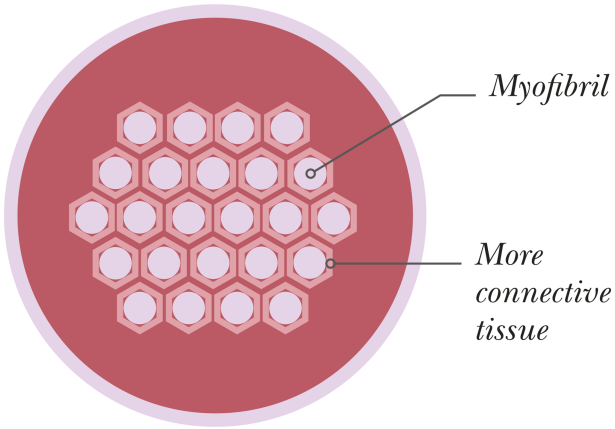
A rise in the volume of the sarcoplasm (which includes mitochondria, sarcoplasmic reticulum, t-tubules, enzymes and substrates, such as glycogen) also enlarges the muscle fibre.



Double-tap image to read the labels

CONNECTIVE TISSUE HYPERTROPHY

The extracellular matrix of the muscle fibre is a three-dimensional scaffolding of connective tissue. Increases in its mineral and protein content lead to muscles getting bigger.



Double-tap image to read the labels

HOW TRAINING PROMOTES MUSCLE GROWTH

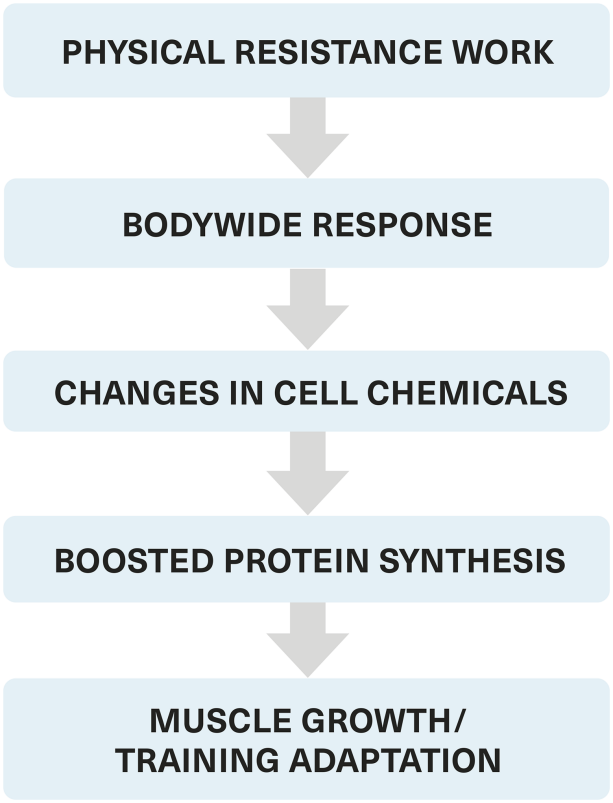
The three stimuli of muscle hypertrophy all work quite differently. The primary driver is mechanical tension, with metabolic stress and muscle damage working on a less direct basis (see Stimuli Of Growth).

MECHANICAL TENSION

For muscle hypertrophy to occur, there must be a mechanical stimulus (or stress). This mechanical stimulus is referred to as mechanical tension or muscular tension.When you contract your muscles against resistance, you create mechanical tension via the force placed on your muscles. Once mechanoreceptors within the muscle detect such tension, a cascade of chemical reactions leading to muscle growth begins.

FROM WORK TO GROWTH

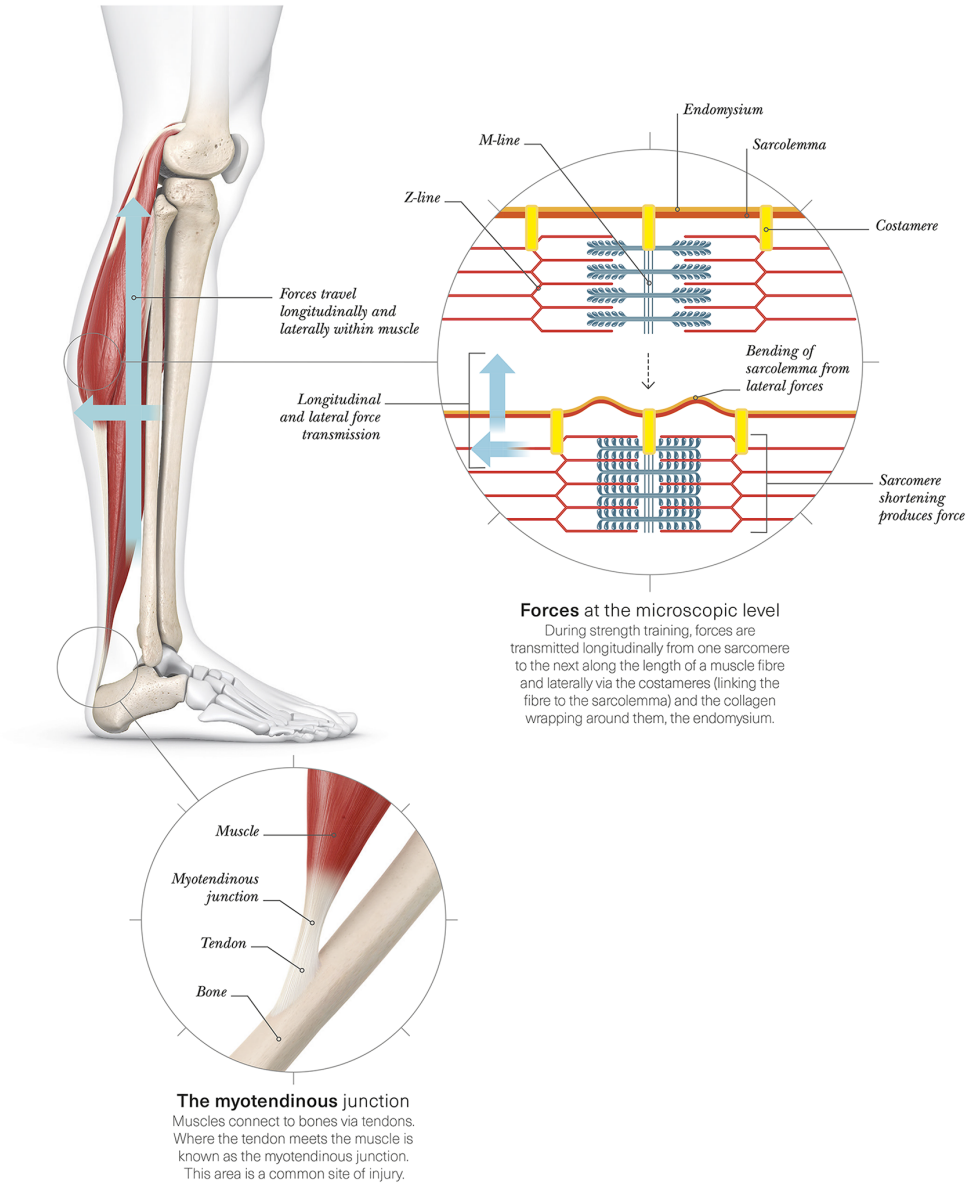
The physical stimulus of resistance work on mechanical tension, in turn, stimulates a range of chemical and biological responses that result in bigger and stronger muscles.



Double-tap image to read the labels

FORCES WITHIN MUSCLES

Both longitudinal and lateral forces generated by muscle contractions are ultimately transmitted to bones and tendons to generate movement.



Forces at the microscopic level

During strength training, forces are transmitted longitudinally from one sarcomere to the next along the length of a muscle fibre and laterally via the costameres (linking the fibre to the sarcolemma) and the collagen wrapping around them, the endomysium.

The myotendinous junction

Muscles connect to bones via tendons. Where the tendon meets the muscle is known as the myotendinous junction. This area is a common site of injury.

ℹ Double-tap image to read the labels

Forces at the microscopic level

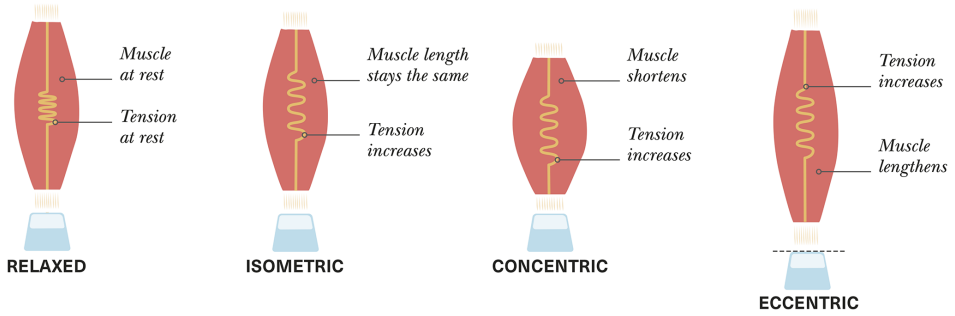
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The myotendinous junction

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The creation of tension in muscles

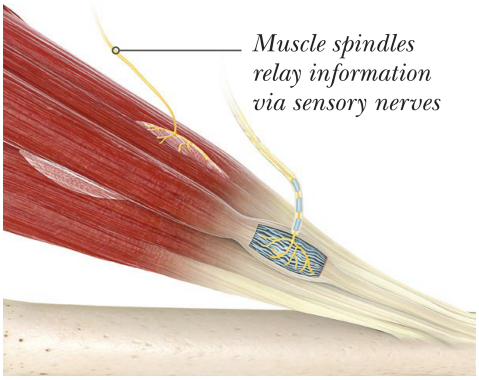
When actively contracting, muscles can generate mechanical, or muscular, tension while shortening, lengthening, or staying the same length. The tension depends on how big or small the overlap is between the actin and the myosin myofilaments within a sarcomere (see The Cycle Of Contraction).



Double-tap image to read the labels

Feedback to the brain

Muscle spindles (within skeletal muscle) are mechanoreceptors sensitive to the magnitude and duration of loading by detecting changes in the length of a muscle. Proprioceptors (located within joints, muscles, and tendons) are sensitive to tension and pressure. These provide the brain with information about the body's posture and position of its parts.

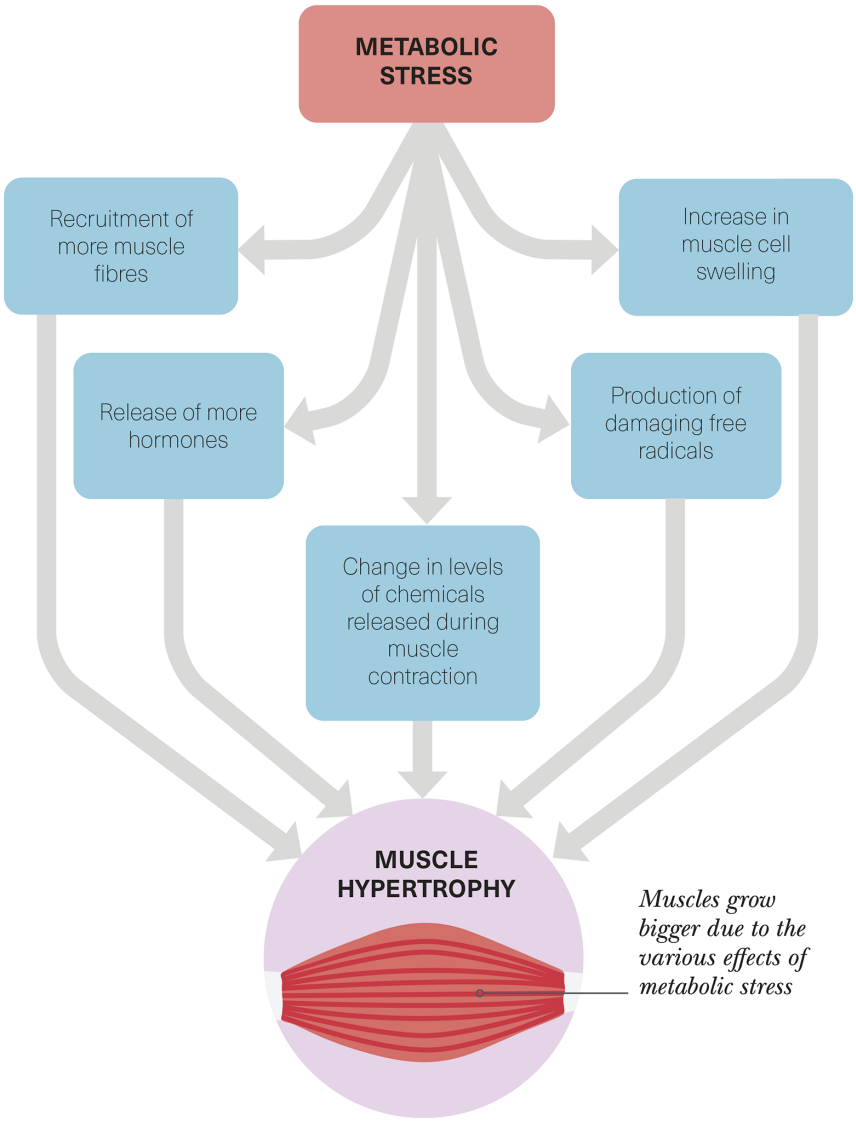


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METABOLIC STRESS

This secondary driver of muscle hypertrophy is an exercise-induced accumulation of metabolites – the intermediate products of metabolic reactions catalyzed by enzymes within a cell; common metabolites are lactate, inorganic phosphate, and hydrogen. Low blood oxygen (hypoxia) can also promote the release of hormones and cytokines (signalling proteins) during contraction. The main theory explains that as muscular fatigue and metabolites build, it leads to higher levels of tension in fast-twitch fibres, stimulating them to grow.

Another by-product of metabolic stress that is thought to contribute to the amount of mechanical tension during muscle contraction is cell swelling (also called "the muscle pump"). Raised internal pressure within the muscle leads to more tension being produced – boosting the total amount of mechanical tension during contraction.



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MUSCLE DAMAGE

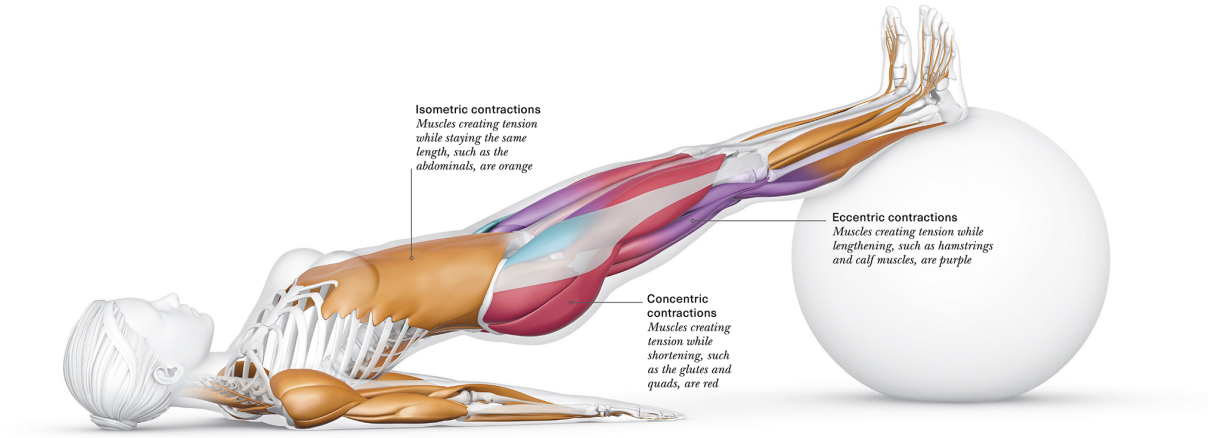
This contributor to muscle growth is specifically exercise-induced muscle damage. It exists on a continuum spanning from mild damage, which can be potentially helpful toward muscle growth, to severe damage, which can cause great disruption of tissues and negative effects across the body.

More damage is not better

A common mistake is that more exercise-induced muscle damage (and soreness) is better. Although muscle soreness is a sign you placed tension in the target muscles, large amounts of muscle damage limit your ability to improve over time. It was once thought that muscle damage was a positive because it impacts on building new muscle. But it's now known that the higher levels of muscle protein synthesis seen are mainly helping to rebuild and repair the muscle after the damage of an intense training session rather than adding new contractile proteins.

HAMSTRING BALL CURL

Within one exercise, different muscles are contracting isometrically, concentrically, and eccentrically. Controlling eccentric contractions is crucial to minimizing mechanistic damage to muscle cells.



Double-tap image to read the labels

Isometric contractions

Muscles creating tension while staying the same length, such as the abdominals, are orange

Concentric contractions

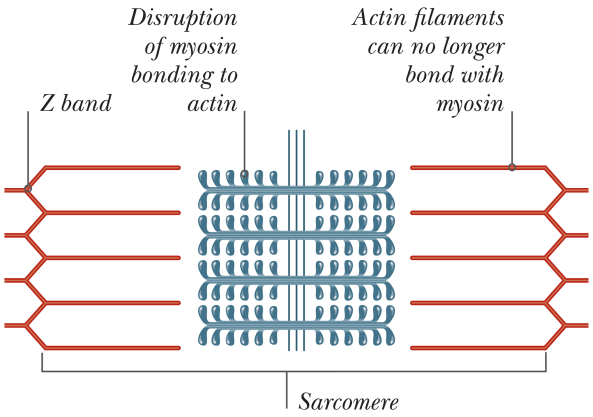
Muscles creating tension while shortening, such as the glutes and quads, are red

Eccentric contractions

Muscles creating tension while lengthening, such as hamstrings and calf muscles, are purple

Damaging eccentric contractions

Muscle damage is caused most often with high training volumes and more exaggerated eccentric contractions, which can cause more mechanistic damages to a muscle cell compared with concentric or isometric contractions. The damage caused by eccentric contractions is due to the mechanical disruption of actin–myosin bonds rather than the ATP-dependent detachment. During intense eccentric actions, sarcomeres are being stretched so much that they start to "pop" – think of the folds in the bendy section of a straw – one after the other along the muscle fibre length. The filaments fit back together afterward but it results in muscle soreness.

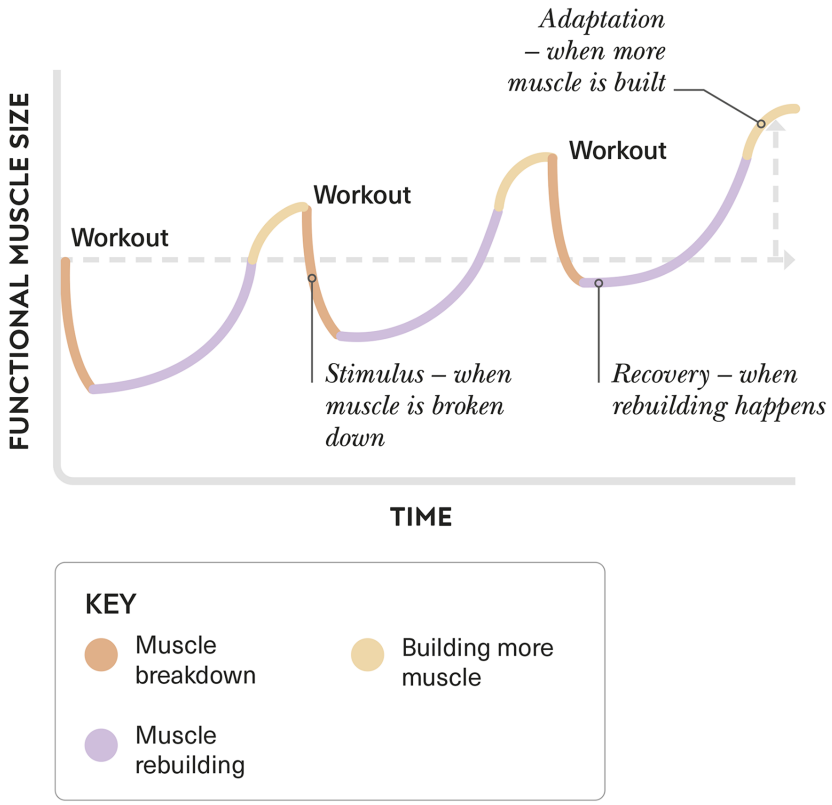


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A POPPED SARCOMERE

Recovery is vital to build muscle

The short period of muscle damage due to the intensity of a workout is followed by a longer recovery time, which is key for rebuilding damaged muscle fibres. If you train without enough chance for muscles to recover between sessions, you'll miss out on the opportunity to rebuild muscle, which will detrimentally affect your performance (see training too infrequently).



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HOW TRAINING PROMOTES BONE STRENGTH

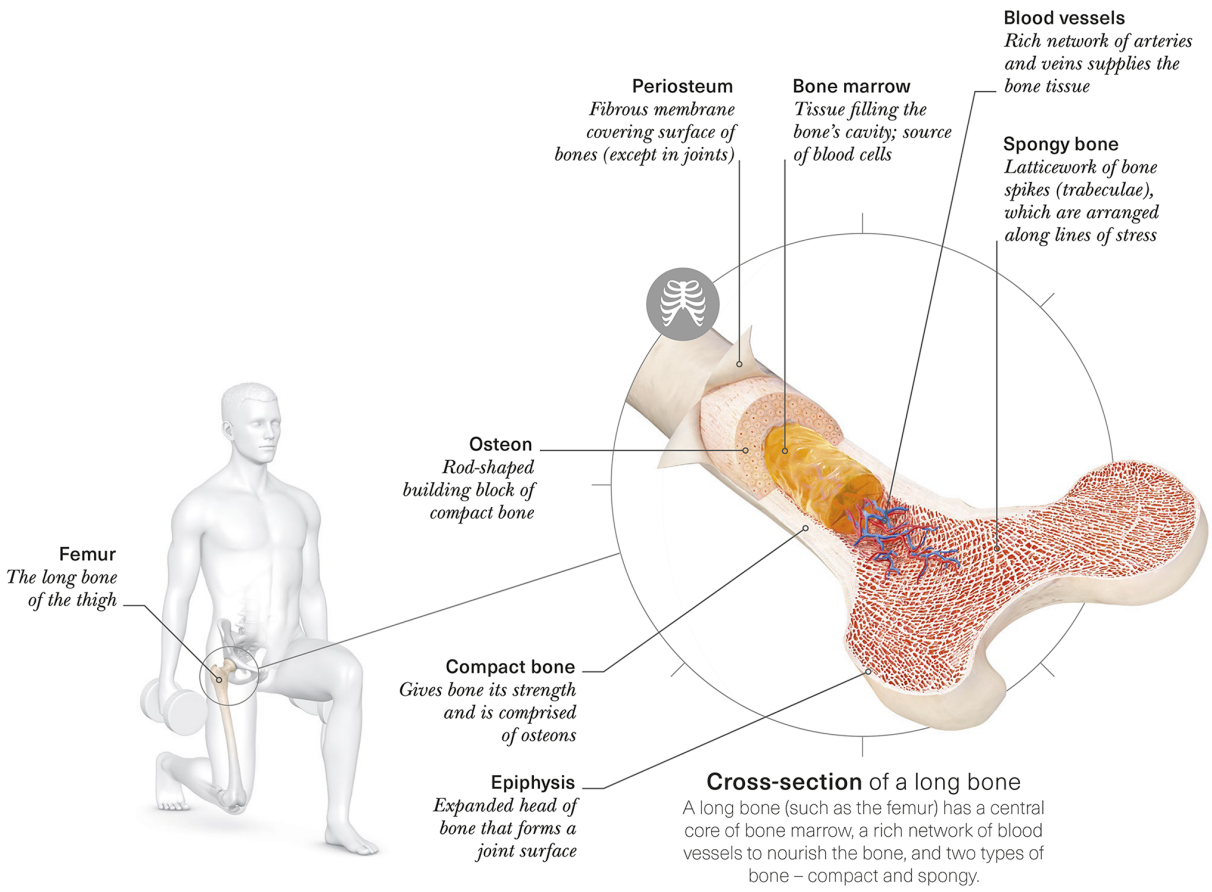
Bone is one of the most overlooked, sophisticated, properties in the human body. It forms the functional framework for human movement and is directly associated with injury incidence, quality of life, and mortality.

HOW BONE IS MADE

Bones increase in size and strength, via the action of osteoblasts, when placed under stress or mechanical load. When inactive or not challenged, bone is resorbed by the action of osteoclasts, resulting in the loss of strength, size, and overall density. The structure of bone is maintained by gravitational forces placed on your body, alongside the lateral forces associated with muscle contraction acting directly on the bone through connective tissue.

LOOK INSIDE A BONE

Bone is a living connective tissue made up of specialized cells and protein fibres. Its layers – compact bone around spongy bone – give it immense strength while being light.



Double-tap image to read the labels

Cross-section of a long bone

A long bone (such as the femur) has a central core of bone marrow, a rich network of blood vessels to nourish the bone, and two types of bone – compact and spongy.

Femur

The long bone of the thigh

Periosteum

Fibrous membrane covering surface of bones (except in joints)

Osteon

Rod-shaped building block of compact bone

Bone marrow
Tissue filling the bone's cavity; source of blood cells

Compact bone
Gives bone its strength and is comprised of osteons

Blood vessels
Rich network of arteries and veins supplies the bone tissue

Spongy bone
Latticework of bone spikes (trabeculae), which are arranged along lines of stress

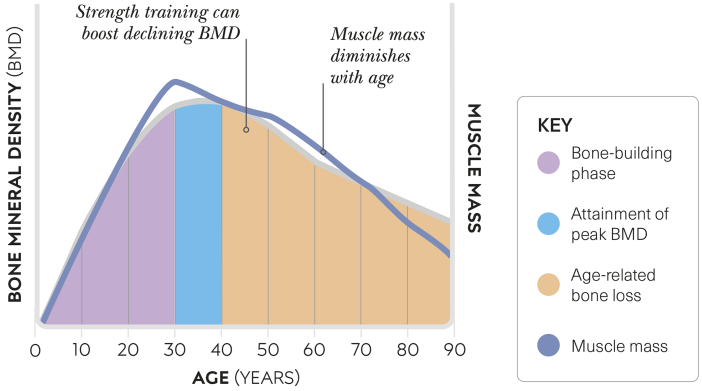
Epiphysis
Expanded head of bone that forms a joint surface

Strengthening bones and muscles for life

Regular strength training has been shown to reduce the risk of both osteoporosis (weak and fragile bones) and sarcopenia (loss of muscle mass). In fact, these two diseases are a “hazardous duet” (osteosarcopenia), since they add to the susceptibility of falls and broken bones in older people.

HOW BONE AND MUSCLE CHANGES

Regular resistance training has been shown to positively impact bone mineral density and content, which reduces the risk of osteoporosis.



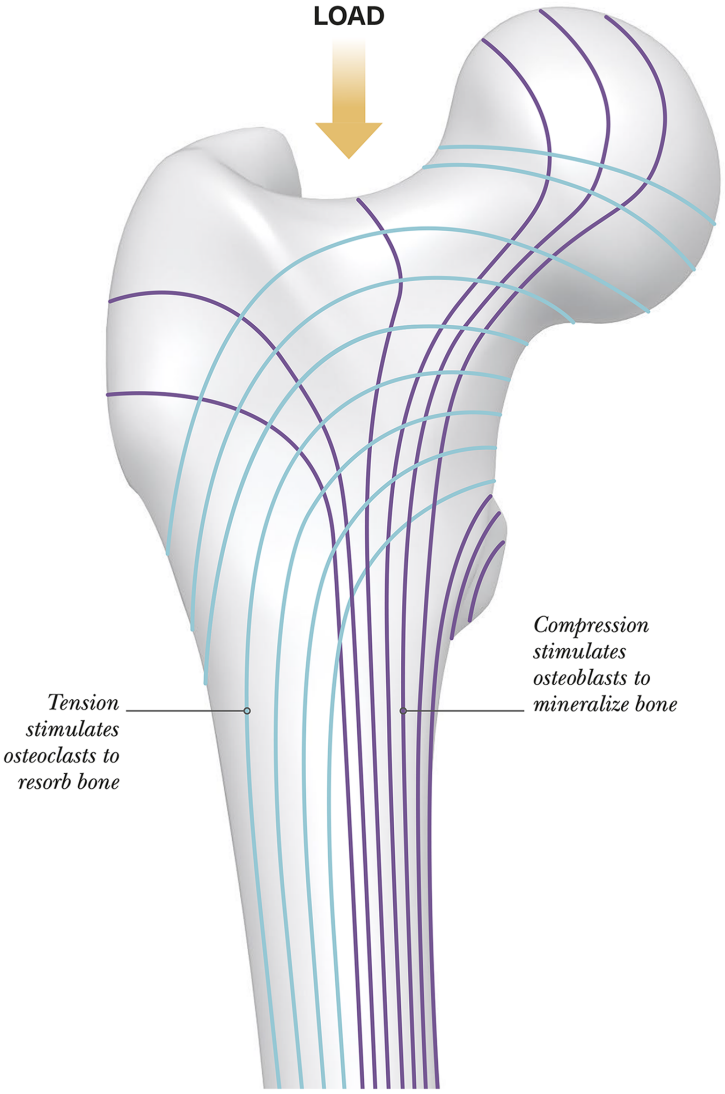
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HOW **BONE** IS **REMODELLED**

Your skeleton is in a constant state of flux, with osteoclasts breaking it down and osteoblasts making new bone. The force of a load – which can just be your bodyweight – confers different influences on this cyclical process depending on whether tension or compression forces dominate. If there is no external load on the skeleton, such as when sitting, osteoclast activity predominates. So, a sedentary life is particularly bad for bones.

BONES IN FLUX

The combined action of osteoclasts and osteoblasts in response to an external load increases bone density.



Double-tap image to read the labels

THE MECHANICS OF MOVEMENT

The primary mechanical role of the skeleton is to provide rigid levers for muscles to act against. Strength training capitalizes on the opposing forces of muscles and external load to work hard to move both the body and the external resistance.

HOW MUSCLES MOVE THE BODY

Your body is basically a system of lever arrangements. Any lever set-up has a lever arm (bones), an axis (joints), force to move the load (provided by muscles, which pull on the bones), and the resistance offered by the weight of your body or by an external load.

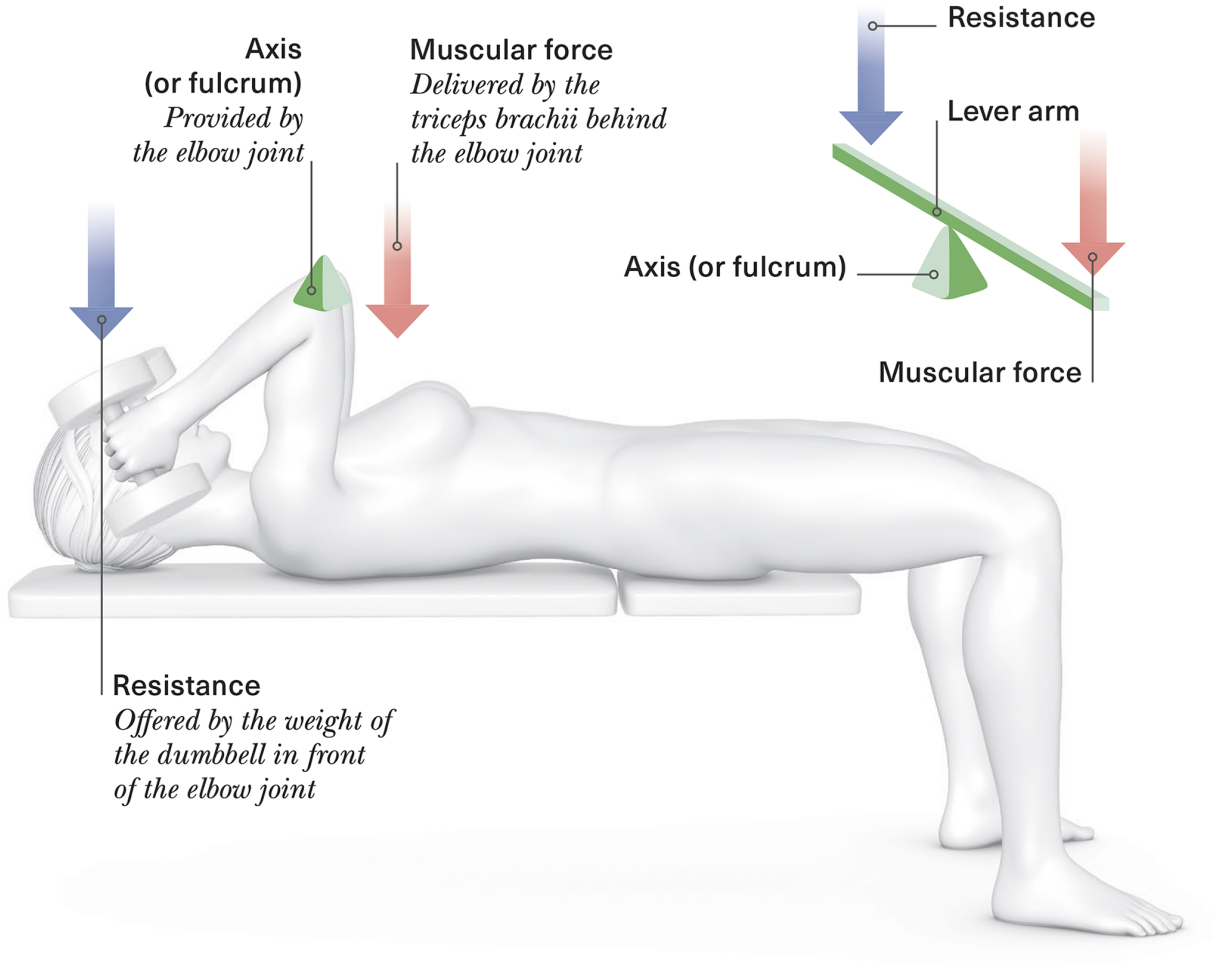
A lever is useful to transform a small force into a much bigger one – what's known as mechanical advantage – so you can generate useful forces over short distances, which give speed with strength.

Whereabouts on the lever arm the muscular force and resistance are applied, in relation to a joint, determines the leverage in lifting a weight. In the human body, there are three different lever systems differentiated into classes: first, second, and third.

FIRST-CLASS LEVER SYSTEM

The muscular force and resistance are applied on opposite sides of the joint – the rarest type of lever system in the human body. As well as the triceps extension shown, another example of a first-class lever is

the nodding of the head on its axis at the atlanto-occipital joint at the top of the spine.



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DUMBBELL TRICEPS EXTENSION

Resistance

Offered by the weight of the dumbbell in front of the elbow joint

Axis (or fulcrum)

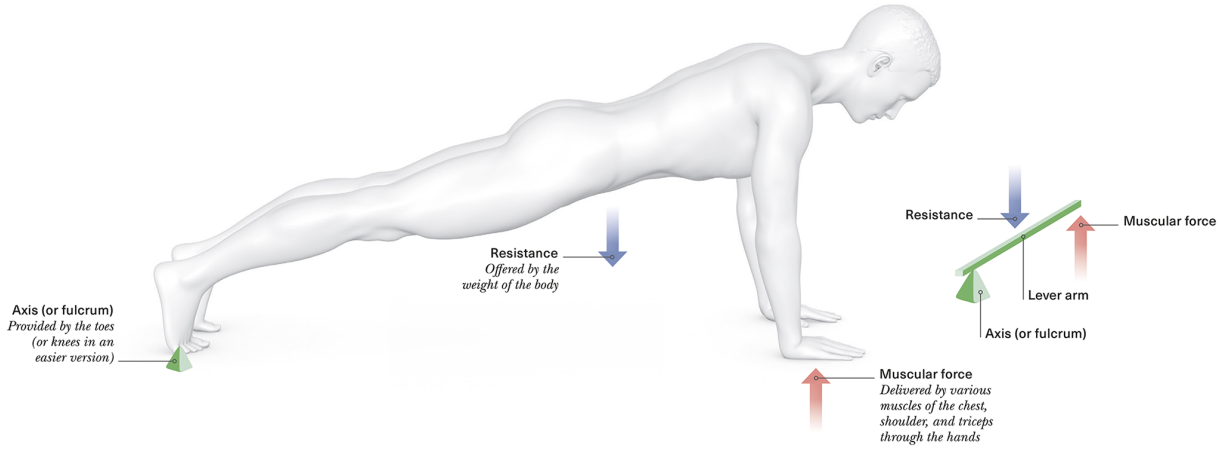
Provided by the elbow joint

Muscular force

Delivered by the triceps brachii behind the elbow joint

SECOND-CLASS LEVER SYSTEM

Within this class of levers, the muscular force and resistance are applied on the same side of the joint, only here the muscular force is applied further from the axis. As well as the push up shown, another example of a second class lever is the standing calf raise.



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PUSH-UP

Muscular force

Delivered by various muscles of the chest, shoulder, and triceps through the hands

Axis (or fulcrum)

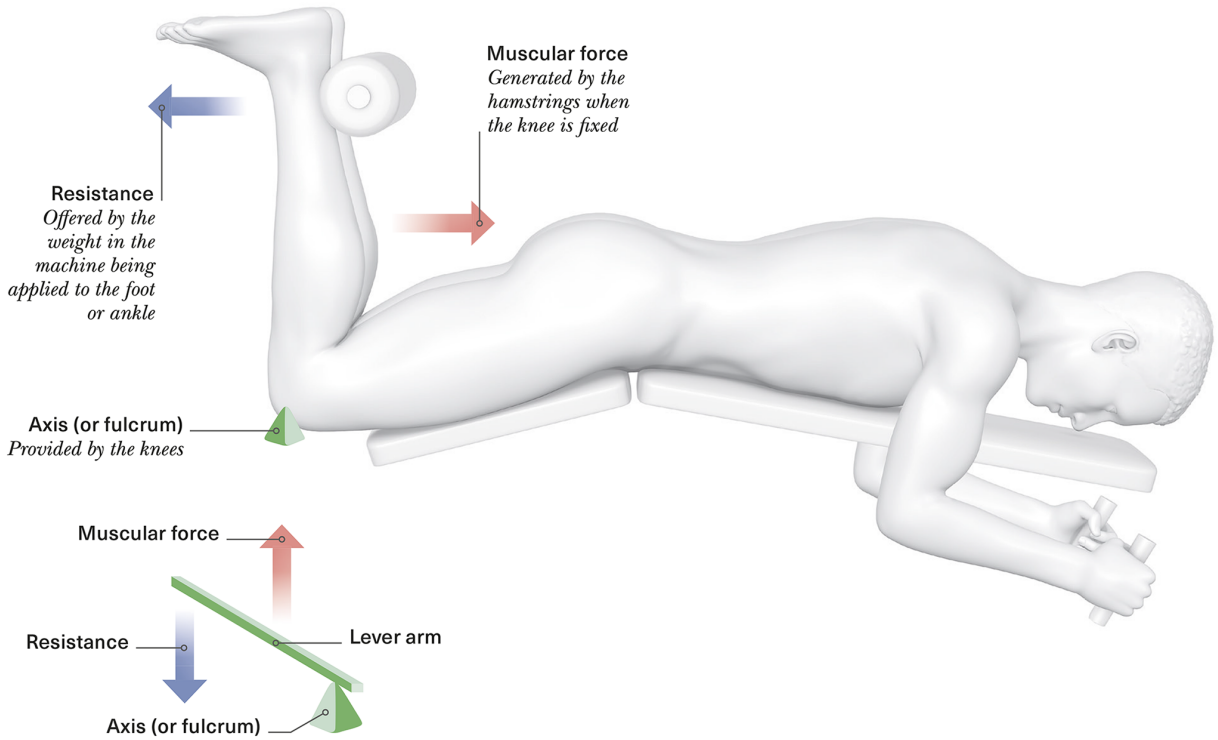
Provided by the toes (or knees in an easier version)

Resistance

Offered by the weight of the body

THIRD-CLASS LEVER SYSTEM

In this class of levers, the muscular force and resistance are applied on the same side of the joint, but here the muscular force is applied closer to the axis. It is the most common type of lever system in the body. As well as the leg curl shown, another example of a third class lever is the biceps curl.



Double-tap image to read the labels

LEG CURL

Resistance
Offered by the weight in the machine being applied to the foot or ankle

Muscular force
Generated by the hamstrings when the knee is fixed

Axis (or fulcrum)
Provided by the knees

POWERING MUSCLE ACTION

Your body is a finely tuned machine that can respond to fast, explosive movements, such as a barbell back squat, as well as endurance activities, such as marathon running, plus everything in between. To do this, it relies on not one but three different systems of energy production.

ENERGY CONVERSION

The flow of energy in a biological system (bioenergetics) happens primarily by the conversion of chemical energy in stored glycogen and macronutrients, such as fats, protein, and carbohydrates (see Fuels For Strength Training), into biologically usable forms of energy.

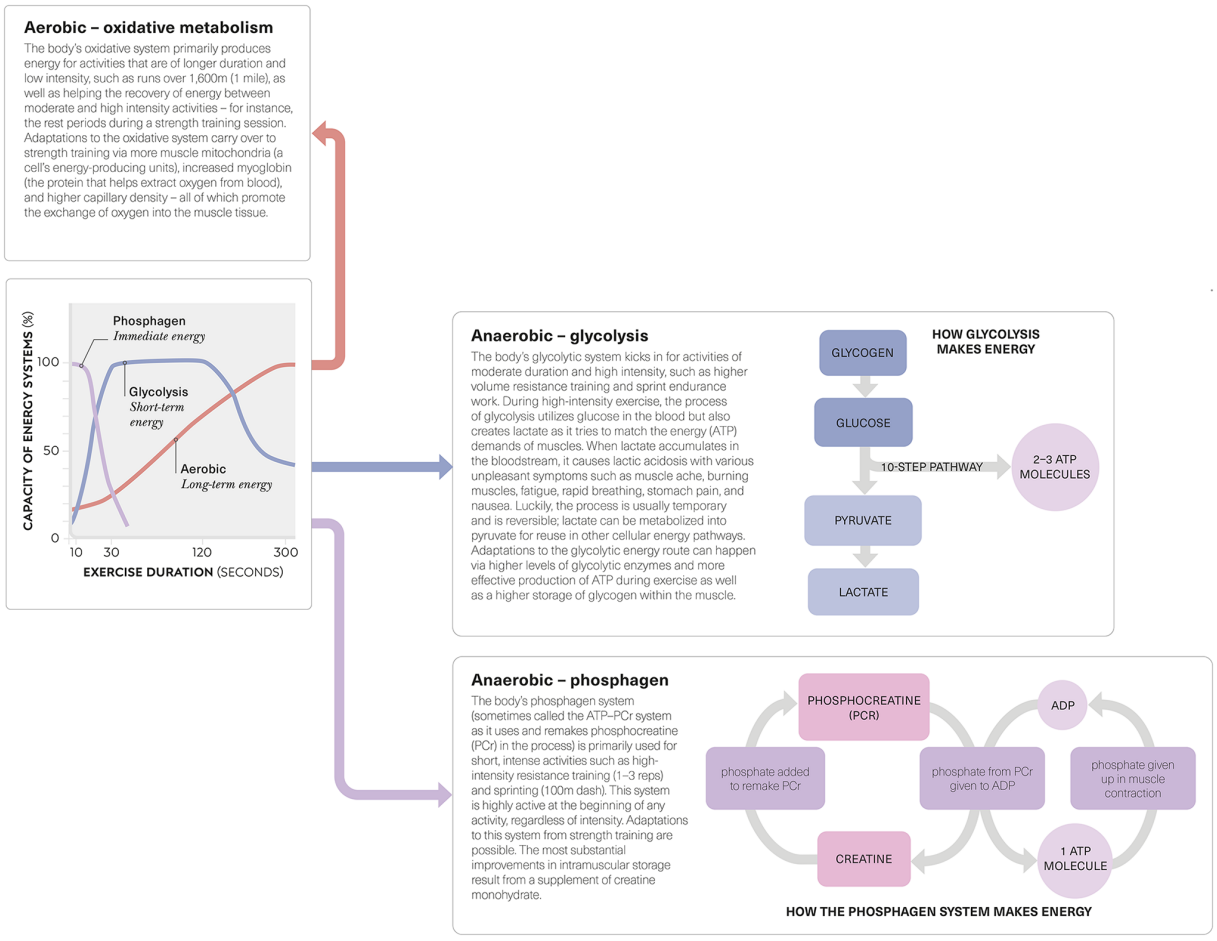
Adenosine triphosphate, or ATP, is the body's principal molecule for storing and transferring energy in cells.

ATP – the cell's energy currency

Almost all cellular processes need ATP, including powering muscular activity. ATP is a nucleotide consisting of an adenine base attached to a ribose sugar, which is attached to three phosphate groups. The three phosphates are linked to one another by high-energy bonds. An ATP molecule releases energy when one phosphate group is removed and, in turn, becomes downgraded to the lower-energy molecule adenosine diphosphate (ADP). ADP and ATP cycle continuously between these two forms as they provide a constant stream of energy for all the body's biological reactions.

HOW THE BODY MAKES ENERGY

Energy processes can be broadly broken down into those that are anaerobic (not dependent on oxygen) and those that are aerobic (oxygen dependent). Anaerobic metabolism involves the phosphagen and glycolytic systems while aerobic metabolism involves the oxidative system. It is important to note that all three systems are active at any given time. Which system is more dominant – and is being used to a greater magnitude – is relative to the intensity and the duration of the activity.



ℹ Double-tap image to read the labels

Aerobic – oxidative metabolism

The body's oxidative system primarily produces energy for activities that are of longer duration and low intensity, such as runs over 1,600m (1 mile), as well as helping the recovery of energy between moderate and high intensity activities – for instance, the rest periods during a strength training session. Adaptations to the oxidative system carry over to strength training via more muscle mitochondria (a cell's energy-producing units), increased myoglobin (the protein that helps extract oxygen from blood), and higher capillary density – all of which promote the exchange of oxygen into the muscle tissue.

Anaerobic – glycolysis

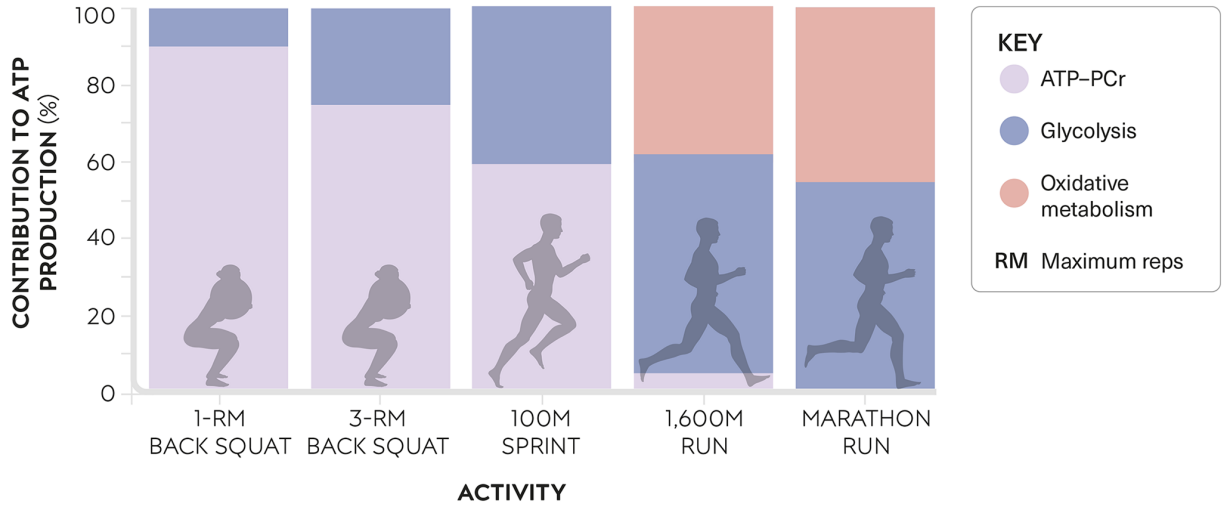
The body's glycolytic system kicks in for activities of moderate duration and high intensity, such as higher volume resistance training and sprint endurance work. During high-intensity exercise, the process of glycolysis utilizes glucose in the blood but also creates lactate as it tries to match the energy (ATP) demands of muscles. When lactate accumulates in the bloodstream, it causes lactic acidosis with various unpleasant symptoms such as muscle ache, burning muscles, fatigue, rapid breathing, stomach pain, and nausea. Luckily, the process is usually temporary and is reversible; lactate can be metabolized into pyruvate for reuse in other cellular energy pathways. Adaptations to the glycolytic energy route can happen via higher levels of glycolytic enzymes and more effective production of ATP during exercise as well as a higher storage of glycogen within the muscle.

Anaerobic – phosphagen

The body's phosphagen system (sometimes called the ATP–PCr system as it uses and remakes phosphocreatine (PCr) in the process) is primarily used for short, intense activities such as high-intensity resistance training (1–3 reps) and sprinting (100m dash). This system is highly active at the beginning of any activity, regardless of intensity. Adaptations to this system from strength training are possible. The most substantial improvements in intramuscular storage result from a supplement of creatine monohydrate.

ENERGY FOR ACTIVITIES

The contribution the three energy systems supply to enable a range of activities varies. The ATP—PCr system powers strength training work but other systems help replenish ATP between sets.



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FUELS FOR STRENGTH TRAINING

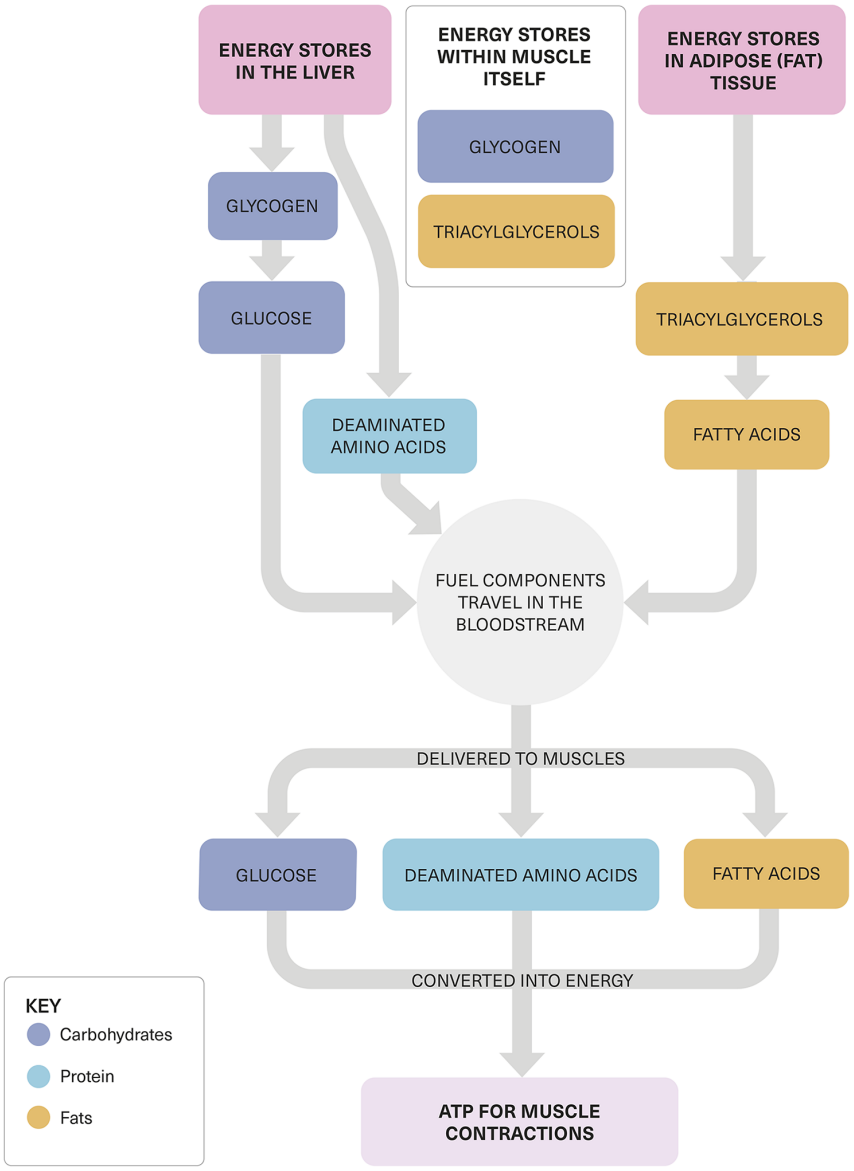
The term "macronutrient" may not be familiar but you've probably heard of the three types – carbohydrates, fats, and protein. The calories within these macronutrients are released for energy to be used in chemical reactions in the body, including powering muscles to work against resistance. There are also "micronutrients" – the vitamins and minerals crucial to a wide and varied range of body processes.

MACRONUTRIENTS

Each of the three macronutrients is made up of components that can be assembled and then broken down to facilitate energy production – a process called bioenergetics (see Powering Muscle Action). Carbohydrates exist as glucose but are also stored in the form of glycogen (in muscles and in the liver). Proteins are made from amino acids. Fats exist as triacylglycerols and free fatty acids.

MACRONUTRIENT FUEL SOURCES

Whether the fuel comes in the form of carbohydrates, proteins, or fats, the body breaks it down and delivers components to the muscles in the blood. Muscle cells use these fuels to make energy – ATP. In addition to glycogen and triacylglycerols, muscles have stores of ATP and amino acids.



Double-tap image to read the labels

Carbohydrate

In strength training, the predominant source of fuels comes from carbohydrates, stored in the form of glycogen and converted into energy through anaerobic metabolism. Eating carbs is key to replenish glycogen stores between training sessions to ensure adequate recovery and subsequent performance. Although your body can manufacture glucose from protein and fat, carbohydrates should make up the largest percentage of your daily energy requirements –

especially if you are strength training. Carbs are responsible for as much as 80 per cent of ATP production during strength training.

Carbohydrate provides 4 kcal of energy per g

The current suggested amount for an exercising adult is **2–5g of carbohydrates/kg bodyweight/day.**



A 70KG (154LB) ADULT REQUIRES 140–350G* OF CARBS A DAY

*depending on energy demands and body composition

Protein

Dietary protein is essential to life and the maintenance of health, especially when considering its importance in building and maintaining muscle, the growth and repair of tissues and cells, and structural roles in connective tissue, bones, and organs. Unlike carbs and fats, the body does not have reserves of protein to use when availability is low, which is why it is crucial to eat enough protein every day. Twenty amino acids are used in human bodily functions; these can be further broken down as essential and non-essential. Essential amino acids have to be consumed in our diet, while the body can synthesize non-essential acids from other protein sources.

Protein provides 4 kcal of energy per g

The current suggested amounts for an exercising adult is **1.6–2.2g of protein/kg bodyweight/day.**



A 70KG (154LB) ADULT REQUIRES 112–154G* OF PROTEIN A DAY

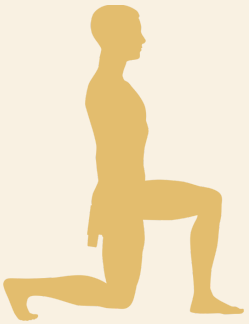
*depending on energy demands and body composition

Fat

Fat, also known as lipid, is an essential nutrient that plays a vital role in many body functions, including the protective cushioning of internal organs and nerve signal transmission, assisting the absorption of vitamins, and helping facilitate the production of cell membranes and hormones. In the body, fat is stored in adipose tissue. Adequate fat intake has been shown to have an impact on testosterone levels, playing an important role in building muscle and regulating metabolism. Dietitians recommend that the majority of your fat intake comes from high-quality essential fatty acids, especially polyunsaturated fatty acids.

Fat provides 9 kcal of energy per g

The current suggested amount for an exercising adult is **0.5–1g of fat/kg bodyweight/day.**



A 70KG (154LB) ADULT REQUIRES 35–70G* OF FAT A DAY

*depending on energy demands and body composition

Micronutrient magic wands

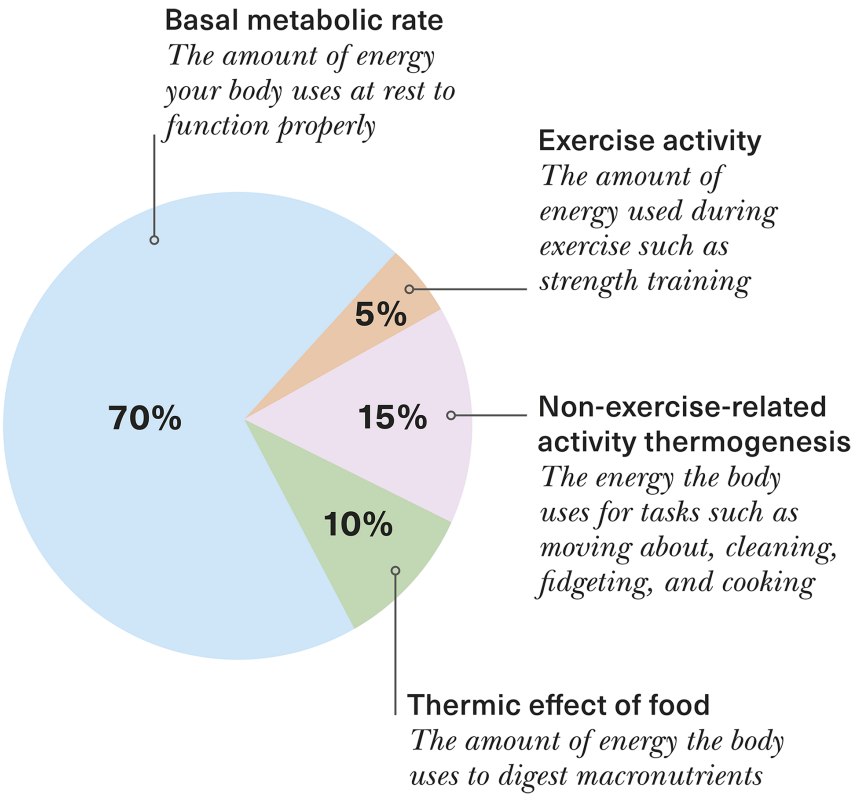
Micronutrients are the vitamins and minerals required by the body in “micro”, or small, amounts compared with macronutrients. The World Health Organization has labelled micronutrients the “magic wands” that help our body to produce enzymes and hormones needed for growth and development. Vitamins and minerals play an important role, helping us best prepare for the physiological demands of everyday life and reducing the risk of age-related decline. The more active you are, the greater the need for you to consume a wide variety of micronutrient-rich foods such as fruits and vegetables. Research from 2018 shows it’s best to consume micronutrients within foods rather than simply topping up levels via supplements.

DETERMINING YOUR ENERGY REQUIREMENTS

Your total daily energy balance refers to the relationship between the amount of energy you consume (in calories from macronutrients) and the amount that you use for activity. The amount of calories you take in has a direct impact on your ability to gain, lose, or maintain your bodyweight.

YOUR DAILY ENERGY BALANCE

Often simplified to "calories in vs calories out", energy balance is a little more complex than simply thinking about what you consume and the energy you use through exercise. Your body's total daily energy expenditure covers all kinds of activities, not just exercise (percentages are for an average person). When you consume fewer calories than you expend, you're in a deficit energy balance; when you consume more calories than you expend, you're in a surplus energy balance.



Double-tap image to read the labels

Basal metabolic rate

The amount of energy your body uses at rest to function properly

Exercise activity

The amount of energy used during exercise such as strength training

Non-exercise-related activity thermogenesis

The energy the body uses for tasks such as moving about, cleaning, fidgeting, and cooking

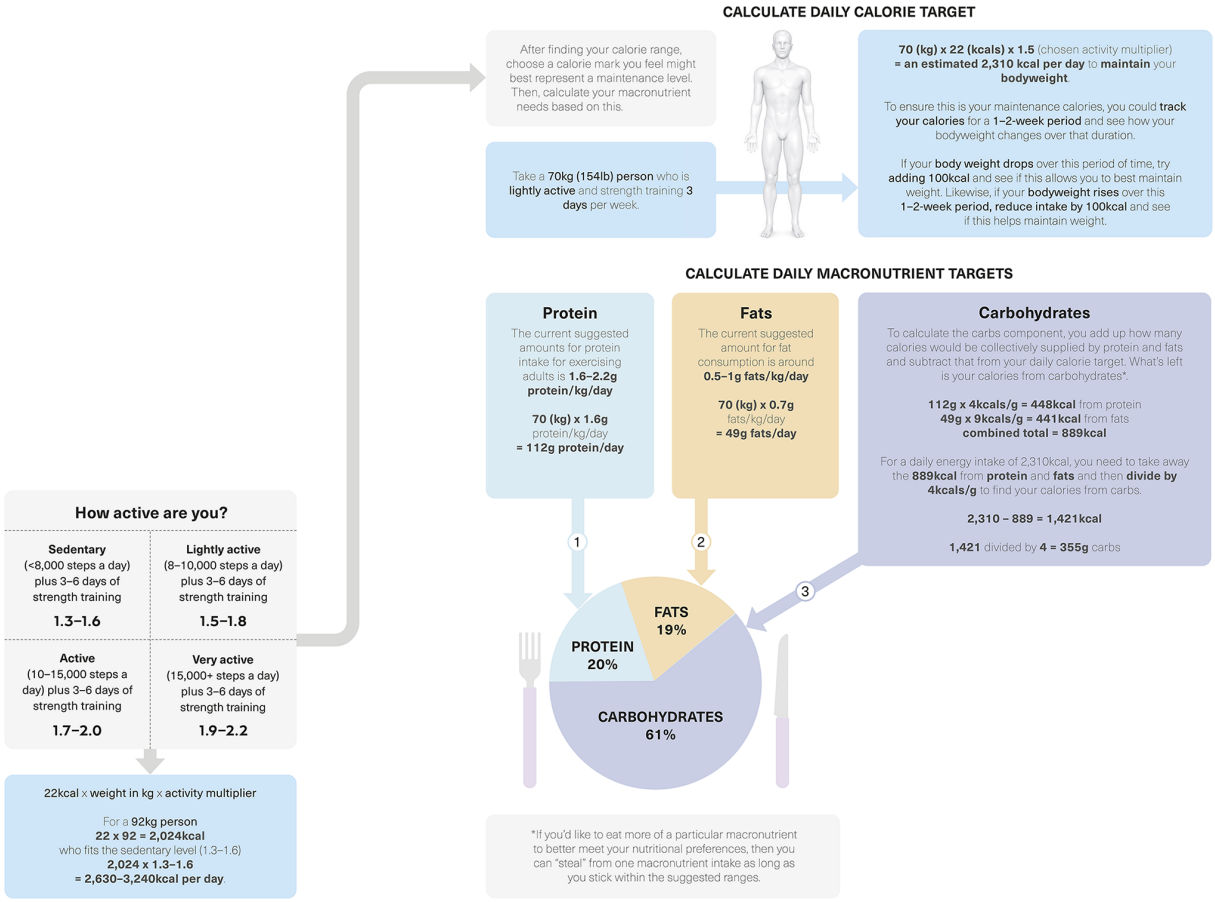
Thermic effect of food

The amount of energy the body uses to digest macronutrients

Your daily calorie intake

In order to best understand how much energy it takes for you to maintain your current bodyweight or body fat levels, you have to do a little bit of maths. Determining maintenance calories is typically done

by taking your bodyweight and multiplying it by 22 (for weights in kg) or by 10 (for weights in lb). Select the activity level from the chart below that best describes you and use this to work out your daily calorie intake to maintain your bodyweight.



ℹ Double-tap image to read the labels

*If you'd like to eat more of a particular macronutrient to better meet your nutritional preferences, then you can "steal" from one macronutrient intake as long as you stick within the suggested ranges.

How active are you?

Sedentary (<8,000 steps a day) plus 3–6 days of strength training **1.3–1.6**	**Lightly active** (8–10,000 steps a day) plus 3–6 days of strength training **1.5–1.8**
Active (10–15,000 steps a day) plus 3–6 days of strength training **1.7–2.0**	**Very active** (15,000+ steps a day) plus 3–6 days of strength training **1.9–2.2**

22kcal x weight in kg x activity multiplier

For a 92kg person

22 x 92 = 2,024kcal

who fits the sedentary level (1.3–1.6)

2,024 x 1.3–1.6

= 2,630–3,240kcal per day.

CALCULATE DAILY CALORIE TARGET

After finding your calorie range, choose a calorie mark you feel might best represent a maintenance level. Then, calculate your macronutrient needs based on this.

Take a **70kg (154lb) person** who is **lightly active** and strength training **3 days** per week.

70 (kg) x 22 (kcals) x 1.5 (chosen activity multiplier)
= an estimated 2,310 kcal per day to **maintain** your **bodyweight**.

To ensure this is your maintenance calories, you could **track your calories** for a **1–2-week period** and see how your bodyweight changes over that duration.

If your **body weight drops** over this period of time, try **adding 100kcal** and see if this allows you to best maintain weight. Likewise, if your **bodyweight rises** over this **1–2-week period, reduce intake by 100kcal** and see if this helps maintain weight**.**

CALCULATE DAILY MACRONUTRIENT TARGETS

Protein

The current suggested amounts for protein intake for exercising adults is **1.6–2.2g protein/kg/day**

70 (kg) x 1.6g
protein/kg/day
= 112g protein/day

Fats

The current suggested amount for fat consumption is around **0.5–1g fats/kg/day**

70 (kg) x 0.7g
fats/kg/day
= 49g fats/day

Carbohydrates

To calculate the carbs component, you add up how many calories would be collectively supplied by protein and fats and subtract that from your daily calorie target. What's left is your calories from carbohydrates*.

112g x 4kcals/g = 448kcal from protein
49g x 9kcals/g = 441kcal from fats
combined total = 889kcal

For a daily energy intake of 2,310kcal, you need to take away the **889kcal** from **protein** and fats and then **divide by 4kcals/g** to find your calories from carbs.

2,310 – 889 = 1,421kcal

1,421 divided by **4 = 355g** carbs

Start with a calorie deficit – to lose weight

To adjust the figures to cut your calories in a balanced way, you'll need to first find your maintenance calorie level. Then, **multiply the calories** by **10–15% – a good size deficit –** and take that away. This uses a **15% deficit** on the above example.

2,310kcal x 0.15 = ~346.5kcal

2,310 – 346.5 = 1,963.5kcal – the new calorie amount.

Start with a calorie surplus – to gain weight

To adjust the figures to boost your calories in a balanced way, you'll need to multiply your maintenance calorie level by **10–15% – a good size surplus–** and add that to the daily goal.

This uses a **15% surplus** on the above example.

2,310kcal x 0.15 = ~346.5kcal

2,310 + 346.5 = 2,656.5kcal – the new calorie amount.

EATING FOR STRENGTH TRAINING

A well-balanced meal can power your strength training routine but it does involve some preparation and planning to include a good variety of vegetables, fruits, lean proteins, and healthy fats. Knowing when to eat, be it before or after a workout, can also make a big difference to your performance and your recovery.

CREATING A WELL-BALANCED MEAL

For muscles to work optimally, they need a constant supply of energy and a source of the macro- and micronutrients needed for repair and recovery. So, your meals should reflect that. Choose any vegetable with the exception of potatoes (classed as a starch) and opt for lean protein (such as chicken, fish, tofu, and yoghurt) as well as healthy fats (in nuts, seeds, and oil-rich foods such as avocado and olive oil).

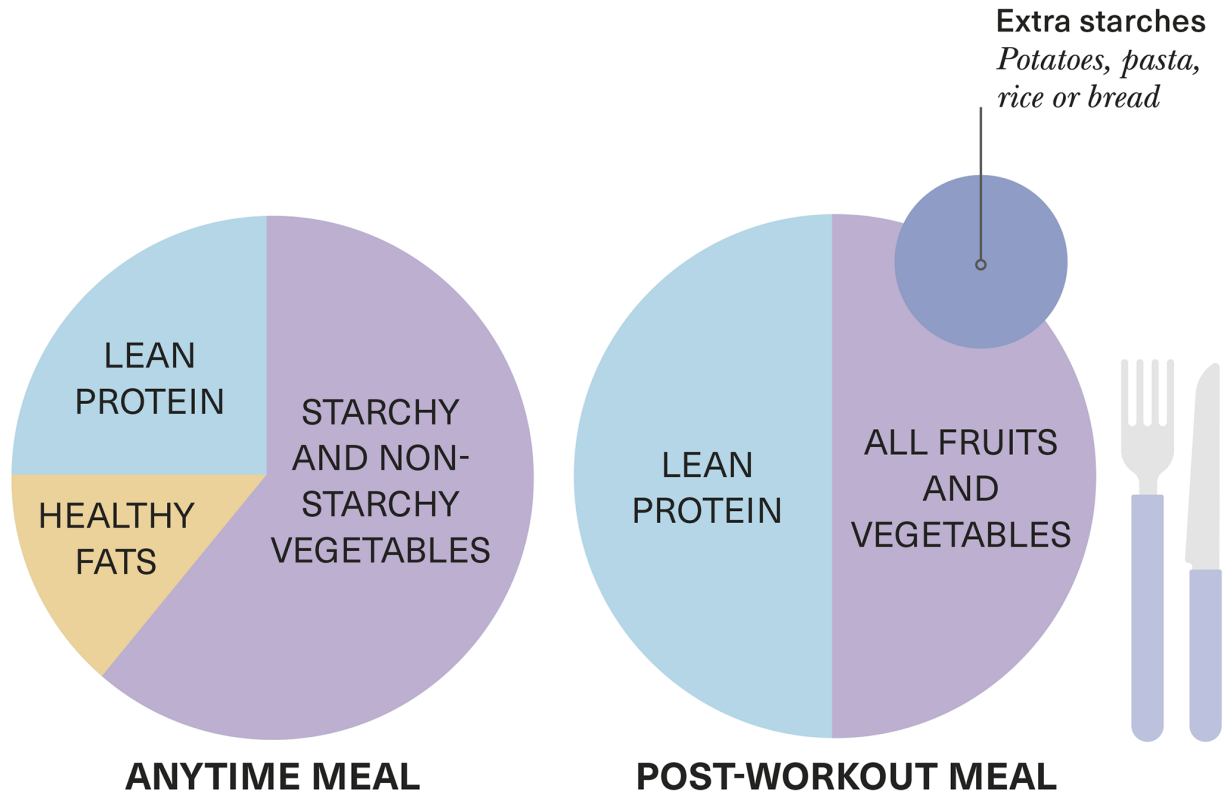
Protein, in particular

When combined with regularly strength training, daily protein intake has been linked in older adults to higher step count, positive impacts on living independently, and improved grip strength (a measure of muscle strength). And these benefits affect younger populations, too. There is evidence to suggest that boosting daily protein intake, such as with high-protein foods or protein powder, can further minimize protein breakdown and promote muscle protein synthesis.

THE RIGHT PROPORTIONS

These "plates" show you what you should be filling up on for most of your meals, and how these proportions skew when eating after a

strength training session.

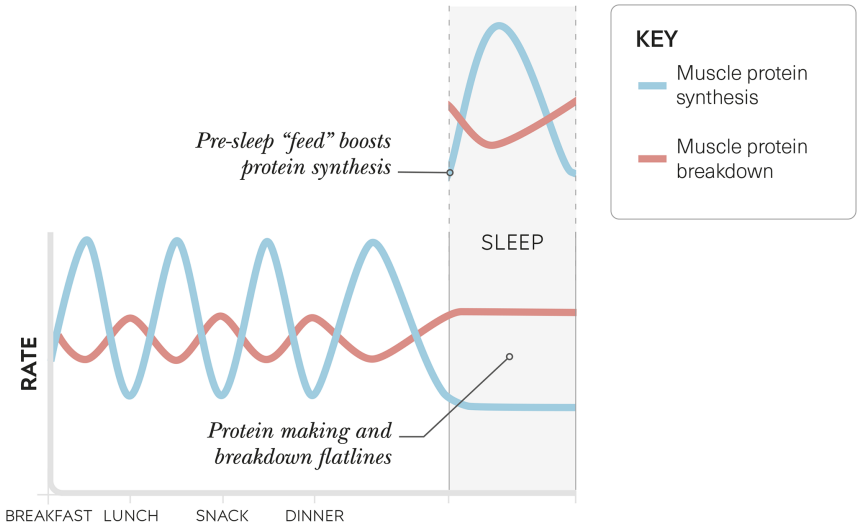


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Extra starches
Potatoes, pasta, rice or bread

FEED MUSCLES WITH PROTEIN

Work with your body's cycles of protein synthesis and breakdown to create an opportunity to transform sleep into a time busy with protein manufacture instead of not much going on.



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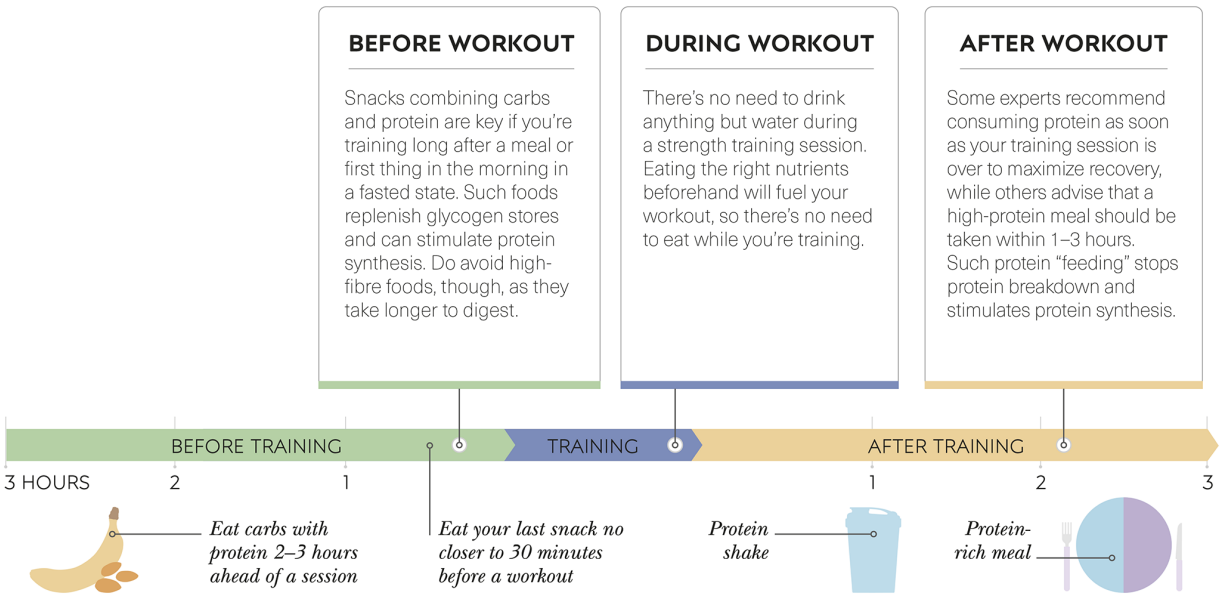
MUSCLE PROTEIN AND ITS DAILY FLUCTUATIONS

PRE- AND POST-WORKOUT NUTRITION

The nutrition surrounding your workout can be an important component of your overall performance and recovery. When choosing a snack before or after a training session, realize that carbohydrate sources differ in digestion rates and their ability to be used for energy. Glucose- and fructose-based sources are great for replenishing muscle and liver glycogen storage (supplying energy for the next workout).

WHAT TO EAT WHEN

The timing of nutrient intake, particularly the "anabolic window" post-workout, has been heavily debated. That said, the middle ground agrees that consuming high-quality protein post-workout (as a supplement or as a meal) has muscle-building benefits.



Double-tap image to read the labels

BEFORE WORKOUT

Snacks combining carbs and protein are key if you're training long after a meal or first thing in the morning in a fasted state. Such foods replenish glycogen stores and can stimulate protein synthesis. Do avoid high-fibre foods, though, as they take longer to digest.

DURING WORKOUT

There's no need to drink anything but water during a strength training session. Eating the right nutrients beforehand will fuel your workout, so there's no need to eat while you're training.

AFTER WORKOUT

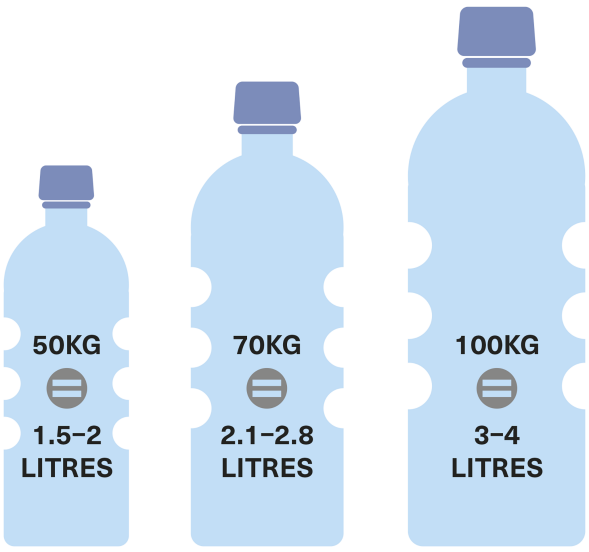
Some experts recommend consuming protein as soon as your training session is over to maximize recovery, while others advise that a high-protein meal should be taken within 1–3 hours. Such protein “feeding” stops protein breakdown and stimulates protein synthesis.

Your fluid balance

Since water makes up 55–60 per cent of a human body, it is a crucial component of day-to-day consumption and one of the most important factors in survival. Water acts as a solvent, a catalyst for chemical reactions, a lubricant and shock absorber, and a source of important minerals, as well as enabling temperature control (sweating). The management of water in and out of the body is known as fluid balance. This delicate equilibrium is essential for performance as well as health. It's vital that this is kept in check and does not turn into dehydration (from not drinking enough water) or hyperhydration (drinking too much water) as both come with health consequences.

HOW MUCH WATER TO DRINK A DAY

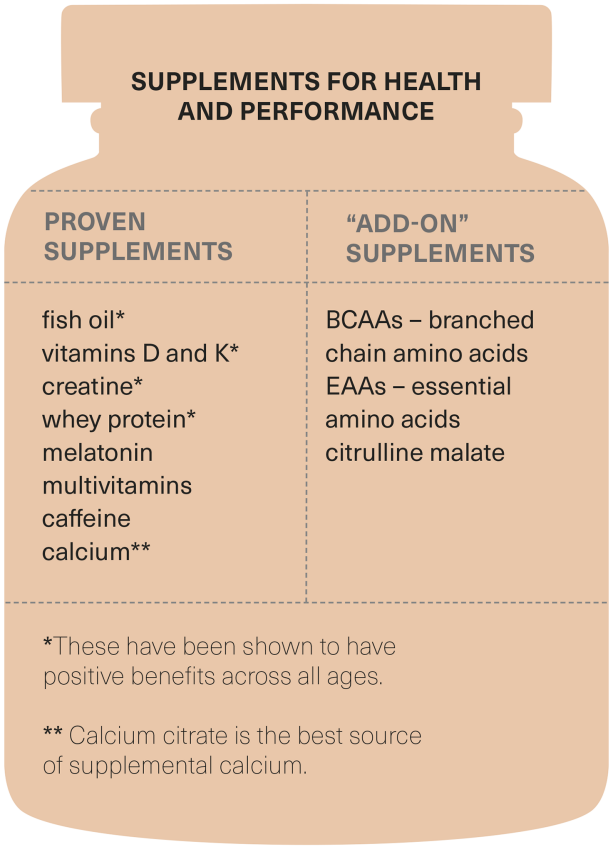
Current advice recommends 30–40ml/kg (½fl oz/lb) bodyweight. It's crucial to tailor your water intake depending on your weight, activity level, perspiration rate, and environmental factors on a daily basis.



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ARE **SUPPLEMENTS** NECESSARY?

There are benefits to supplementation for overall health, performance, and recovery. That said, it's better to focus on eating a well-balanced diet than not to eat nutritious meals and rely on supplements to top you up. The supplements with the most comprehensive impact on health and performance are listed below left. As the research stands, there is no detriment to taking the "add-on" supplements, so view them as an extra or luxury item.



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SUPPLEMENTS FOR HEALTH AND PERFORMANCE

PROVEN SUPPLEMENTS	"ADD-ON" SUPPLEMENTS
fish oil* vitamins D and K* creatine* whey protein* melatonin multivitamins caffeine calcium**	BCAAs – branched chain amino acids EAAs – essential amino acids citrulline malate

*These have been shown to have positive benefits across all ages.

** Calcium citrate is the best source of supplemental calcium.

Protein powders – what's the deal?

If you're already getting enough high-quality protein, the likelihood is that you won't see much benefit from adding protein powder to your diet. But if you're regularly lifting weights, you may find that such powder can maximize muscle gain, and it's useful for those struggling to meet protein needs if following a vegan or vegetarian diet. Protein powders are concentrated sources of protein; some are based on animal protein (whey and casein from milk, or egg), others are based on plant protein (pea, hemp, soy, and rice). If you think a protein powder would help you reach your goals, discuss options with a trainer or dietitian.

TRAINING ON **VEGAN** OR **VEGETARIAN DIETS**

Strength training on a plant-based diet can be just as effective as on an animal-based diet. Although it can be more challenging, it utilizes the same principles of energy availability. Protein intake (specific to the amino acid leucine) is the most challenging of the macronutrients to maximize. Protein intake is invaluable to the maintenance and growth of muscle tissue and overall metabolic health, so learning how best to consume the required nutrients is important for anyone following a plant-based diet.

Pay extra attention to all nutrients

While nutrition is important for the health of everyone, a poorly constructed plant-based diet can put you at risk of macronutrient deficiencies and micronutrient deficiencies for various vitamins and minerals. Look to these vegan-friendly food sources to provide the most commonly lacking nutrients in plant-based diets.

Protein Pulses, grains, legumes, tofu, quinoa, nuts, seeds, vegetables

Vitamin B12 Fortified foods, plant milks, nutritional yeast

Vitamin D Fortified foods, plant milks, nutritional yeast

Iron Legumes, grains, nuts, seeds, fortified foods, green vegetables

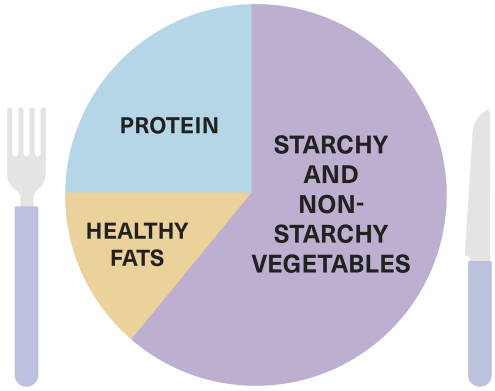
Zinc Beans, nuts, seeds, oats, wheat germ

Calcium Tofu, kale, broccoli, sprouts, cauliflower, bok choy, fortified plant milk

Iodine Seaweed, cranberries, potatoes, prunes, haricot beans, iodized salt

ANYTIME ANIMAL-BASED MEAL

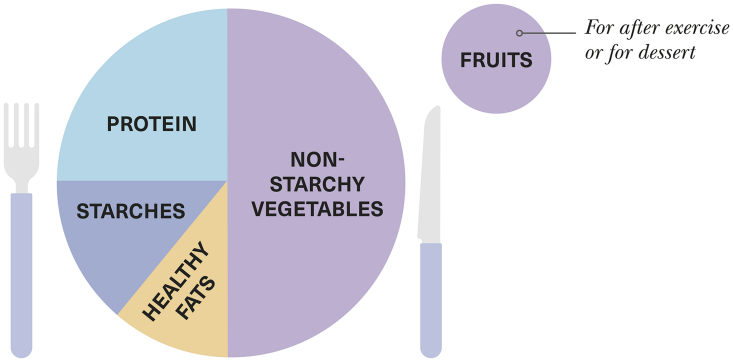
These are the proportions of nutrients recommended for eating a well-balanced diet while doing regular strength training.



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ANYTIME PLANT-BASED MEALS

While the proportions of nutrients varies, the most vital nutrient is protein for those on a vegetarian or vegan diet.



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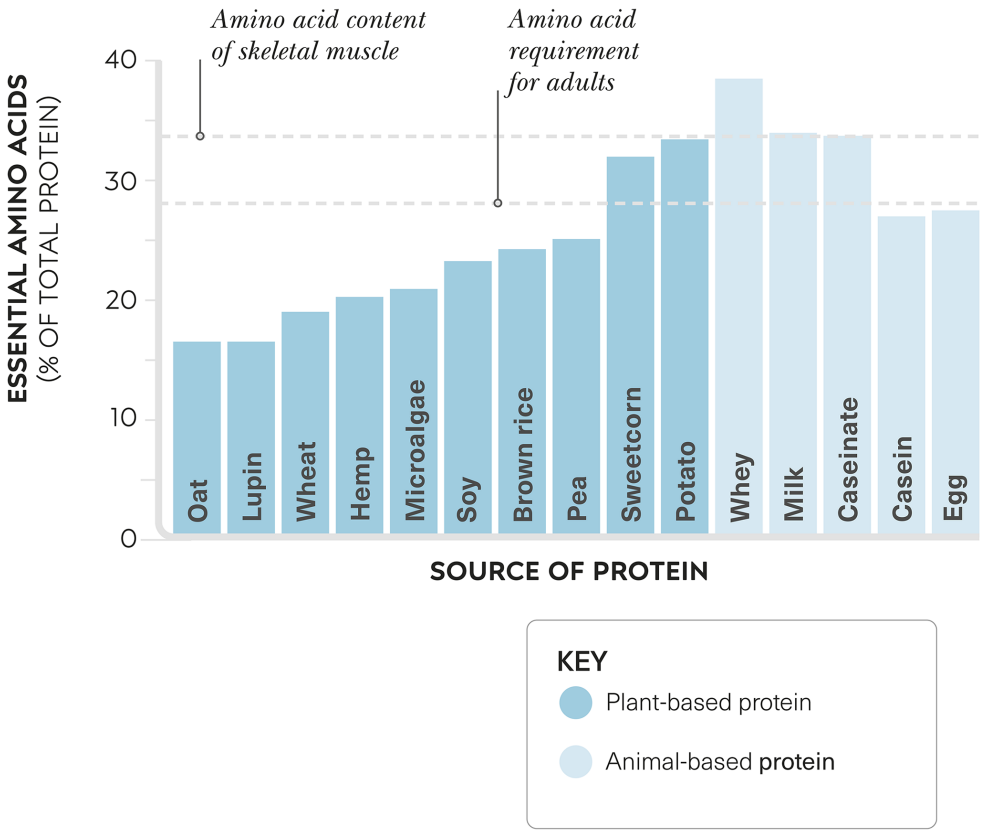
Think “complete protein”

To build skeletal muscle, high-quality protein is of paramount importance. The quality of protein relates to its composition of the essential amino acids (those the body cannot make).A protein is defined as “complete” when it contains all nine essential amino acids in the amounts needed to support the growth and maintenance of lean muscle tissue. An “incomplete” protein is low in essential amino acids. All animal-based proteins (aside from gelatin) are complete proteins. Plant proteins, however, often lack enough essential amino

acids and are by definition incomplete proteins. So, anyone following a plant-based diet has to be more aware of protein quality and how to best pair two incomplete proteins to create a complete one.

HOW PROTEINS COMPARE

Plant proteins mostly fall below the amino acid requirement while animal proteins mostly surpass it.



Double-tap image to read the labels

Veggie protein powders

Whey protein is the most common choice of protein supplements (see image) due to its high leucine content, rapid digestibility, and ability to stimulate protein synthesis. Those following a plant-based diet have different choices. Soy protein has been the most comparable alternative. But pea protein has more recently been proposed as the best alternative to whey protein supplements, as it has shown similar increases in muscular size and strength.

The case for leucine

Leucine is an essential amino acid, specifically one of the branched chain amino acids. It is important in the regulation of skeletal muscle as it can stimulate muscle protein synthesis. There is a certain leucine threshold (amount) per meal to stimulate this process to occur. Although leucine has been shown to switch on muscle protein synthesis, it cannot carry out and sustain this process without other essential amino acids. A complete protein source is required – from protein-rich foods or from a protein supplement. Research has shown that older adults need about double the amount of leucine per meal, on average, to reach the threshold to boost the synthesis of muscle protein.

STRENGTH TRAINING AND YOUR BRAIN

The physical adaptations made early in response to strength training are predominantly in the nervous system. Experts believe that nervous-system-based responses account for the gains made in the first two to four weeks of strength training.

THE CONTROL OF MUSCLES

The nervous system comprises your brain and spinal cord and countless nerves taking messages from your brain to your body and back again. Motor nerves transmit signals about movement from the brain's motor cortex via the spinal cord, whereas sensory nerves relay information from the muscles to the brain and spinal cord.

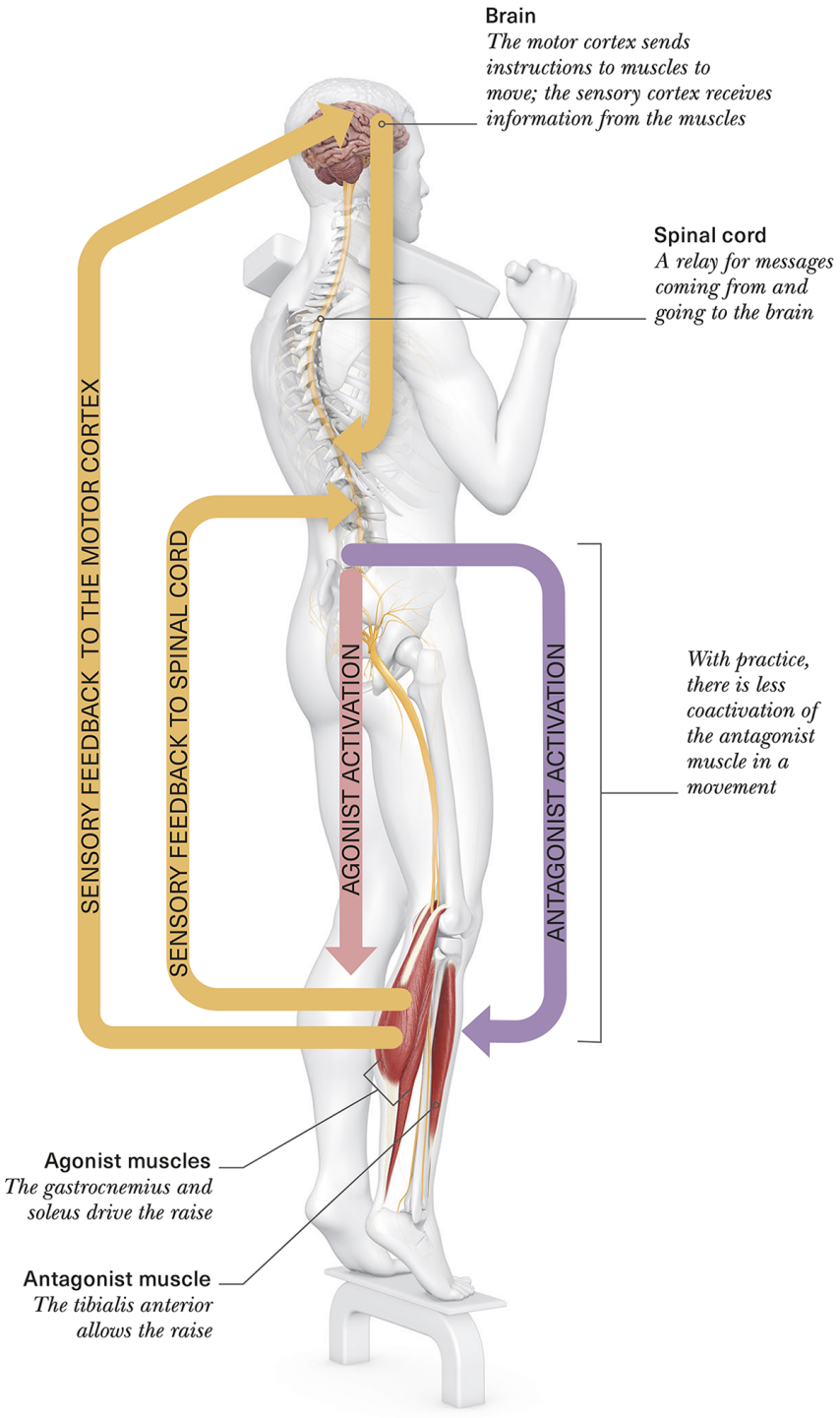
Neural adaptations

Adaptation is a dynamic process whereby the body adjusts to a particular environment. Strength training helps develop motor pathways that enhance brain–body coordination. These "neural adaptations" describe how the brain recruits muscles to contract to produce a particular movement. Practice trains the brain to activate the right muscles for that motion; with time, the movement becomes more automatic. Adaptations in both nervous and muscular systems (which kick in later) result in improved technique, coordination, and efficiency of movement over time.

SMOOTHER MOVES

Your brain sends a signal to activate the agonist of an action. Initially, it also signals to the antagonist at the same time (coactivation). With

repetition, the amount of coactivation diminishes and your technique improves.



Double-tap image to read the labels

Brain
The motor cortex sends instructions to muscles to move; the sensory cortex receives information from the muscles

Spinal cord
A relay for messages coming from and going to the brain

Agonist muscles
The gastrocnemius and soleus drive the raise

Antagonist muscle
The tibialis anterior allows the raise

STRENGTH TRAINING'S **BRAIN GAINS**

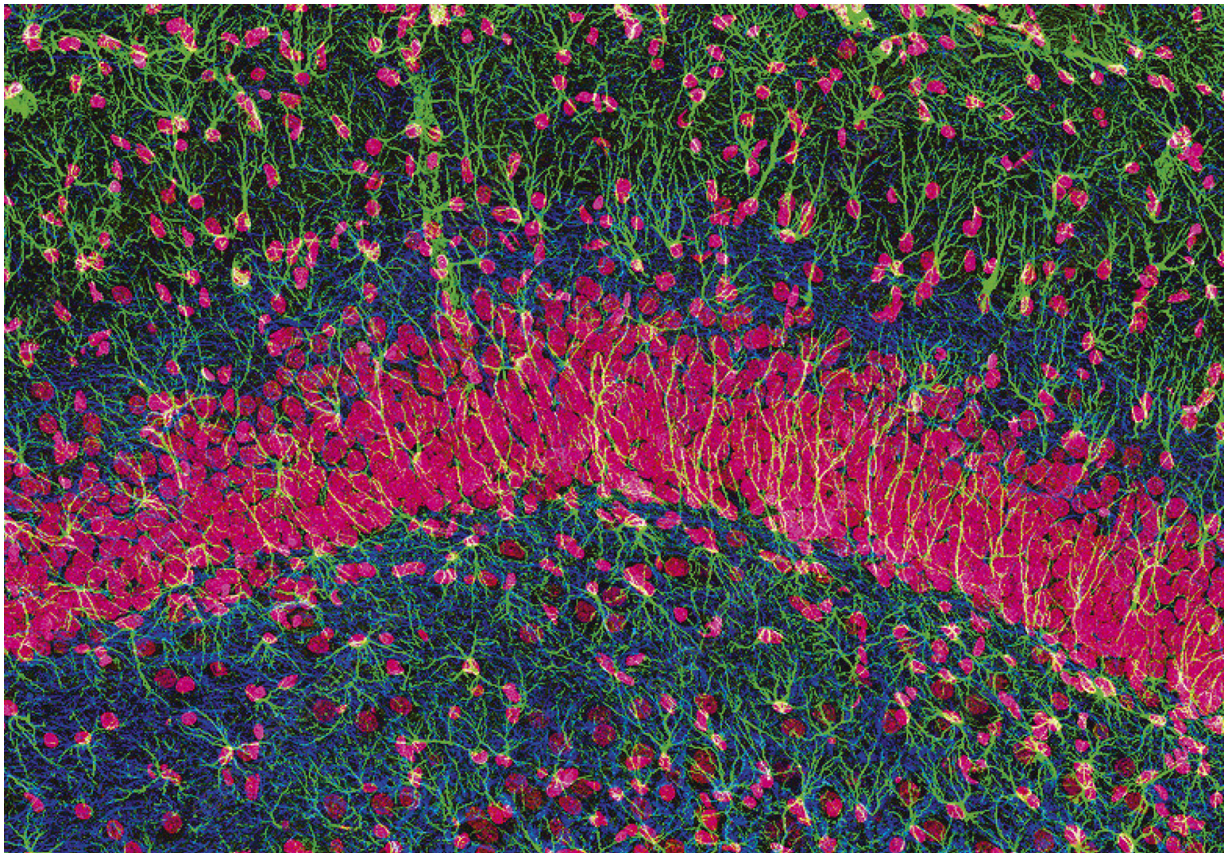
Regular strength training has been shown to increase levels of neurotrophins – a family of growth and survival factors that regulate the development and the maintenance of nerve cells or neurons. Two neurotrophins in particular: brain-derived neurotrophic factor (BDNF) and insulin-like growth factor 1 (IGF-1) have both been shown to have positive effects on neurogenesis and neuroplasticity.

Neurogenesis

The creation of new neurons – neurogenesis – is just one of the positive ways that strength training and exercise impacts the brain. Scientists used to believe that you were born with a certain number of neurons – some 86 billion – and that you couldn't grow new ones. Research has since revealed that neurogenesis can happen and it does so in key areas of the brain, such as in the hippocampus, which is important in memory.

NEW BRAIN CELLS

In this microscopic image of the brain's hippocampus, neuron cell bodies are coloured pink. Strength training promotes neurogenesis, the making of new neurons.

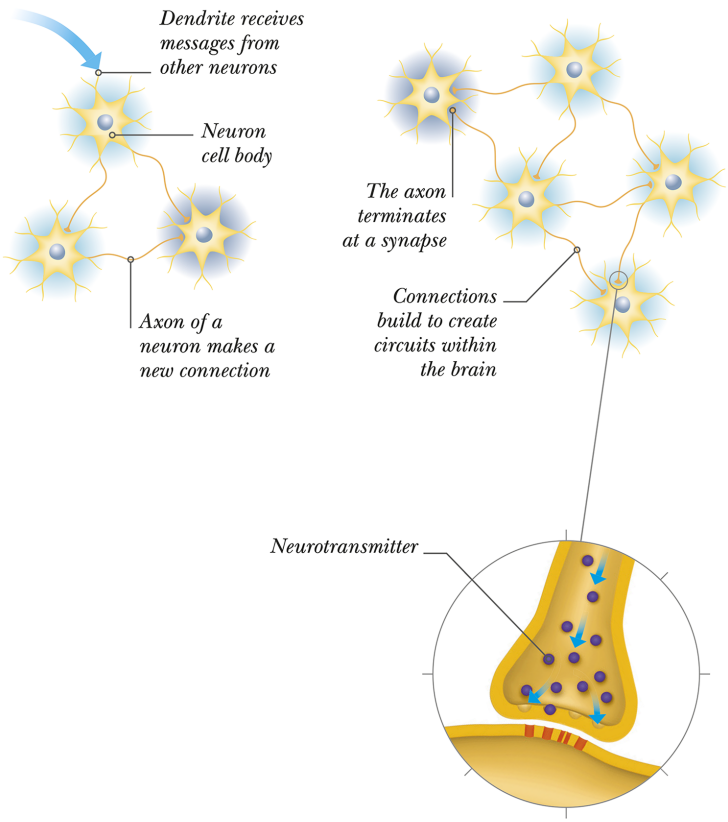


Neuroplasticity

Pathways within the brain become more permanent the more you use them; repetition strengthens and continues to build a neural network. This ability to form new connections and pathways – known as neuroplasticity – changes how brain circuits are wired. Learning a new skill, such as that needed in strength training, improves how existing neurons work and offers positive benefits across brain function.

BUILDING CONNECTIONS

Neurons form new connections in response to a stimulus. Repetition of the stimulus reinforces how the brain is wired.



Synapse, up close
Molecules of neurotransmitter prompted by the signal in one neuron flow across the synapse in about 1 millisecond, relaying the signal to the next connected neuron.

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Synapse, up close

Molecules of neurotransmitter prompted by the signal in one neuron flow across the synapse in about 1 millisecond, relaying the signal to the next connected neuron.

Neurochemistry

Where one neuron meets another there is the tiniest gap, also known as a synapse. To transmit the electrical signal from one neuron to the next, your brain uses a system of molecules called neurotransmitters. These chemicals diffuse across the gap and initiate the signal in the next connected neuron. Strength training exercise boosts levels of

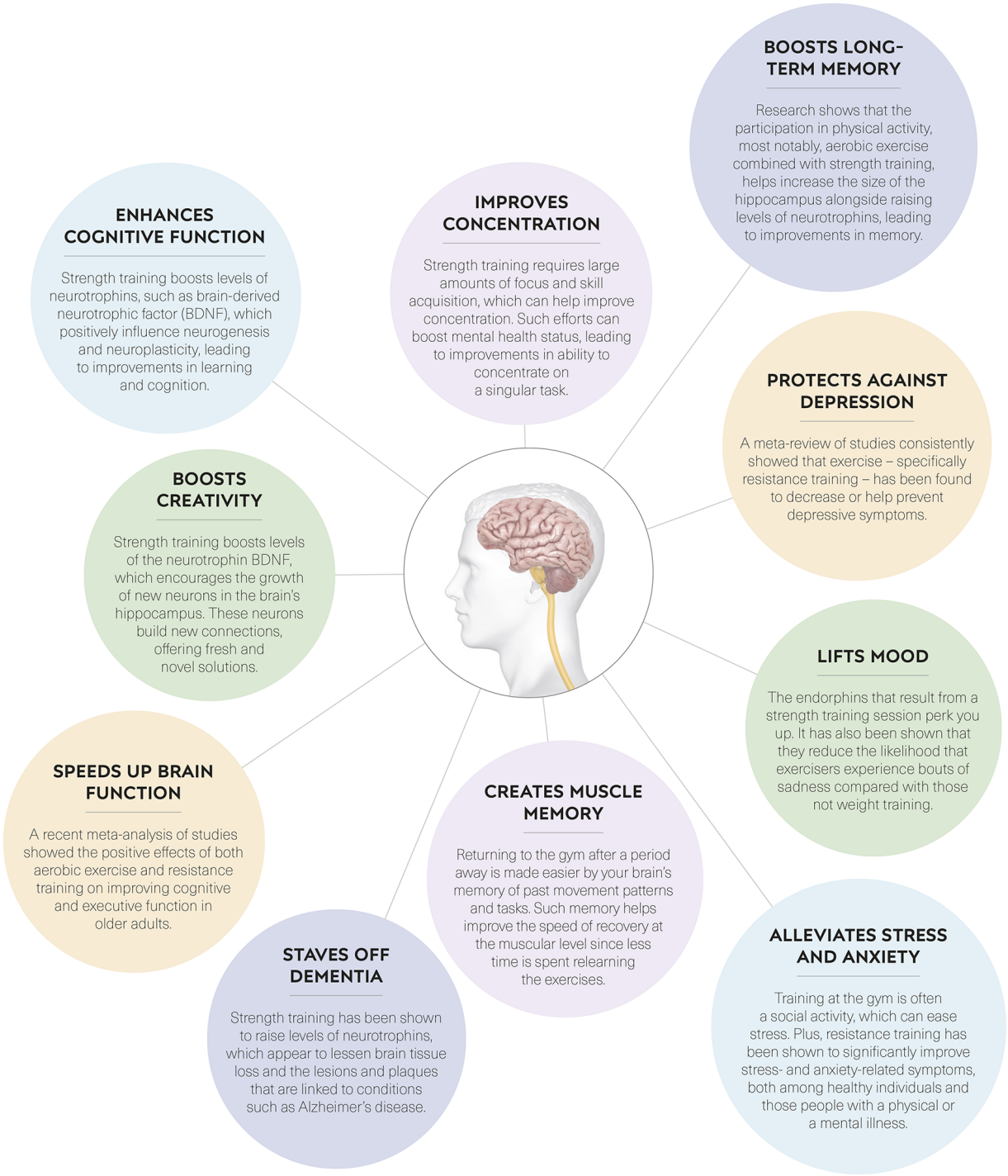
certain neurotransmitters, such as dopamine, as well as levels of endorphins, which lift mood and quell anxiety.

Mind–muscle connection

When strength training, it's good to work without distractions so that you can pay attention to each and every exercise. You can also boost your workout gains by developing a mind–muscle connection. It's the act of consciously and deliberately thinking about moving the target muscle, because research shows that this can really boost muscle strength. Practising such a conscious approach leads to the recruitment of more muscle fibres in a movement, which ultimately means better quality muscle contractions and a more successful workout.

BRAIN-BASED BENEFITS

In addition to the physical health benefits, research is uncovering a host of positive impacts on mental health and the brain from doing regular strength training – reducing stress, boosting productivity, focussing the mind, and enhancing memory are just a few of them.



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ENHANCES COGNITIVE FUNCTION

Strength training boosts levels of neurotrophins, such as brain-derived neurotrophic factor (BDNF), which positively influence neurogenesis and neuroplasticity, leading to improvements in learning and cognition.

IMPROVES CONCENTRATION

Strength training requires large amounts of focus and skill acquisition, which can help improve concentration. Such efforts can boost mental health status, leading to improvements in ability to concentrate on a singular task.

BOOSTS LONG-TERM MEMORY

Research shows that the participation in physical activity, most notably, aerobic exercise combined with strength training, helps increase the size of the hippocampus alongside raising levels of neurotrophins, leading to improvements in memory.

BOOSTS CREATIVITY

Strength training boosts levels of the neurotrophin BDNF, which encourages the growth of new neurons in the brain's hippocampus. These neurons build new connections, offering fresh and novel solutions.

PROTECTS AGAINST DEPRESSION

A meta-review of studies consistently showed that exercise – specifically resistance training – has been found to decrease or help prevent depressive symptoms.

SPEEDS UP BRAIN FUNCTION

A recent meta-analysis of studies showed the positive effects of both aerobic exercise and resistance training on improving cognitive and executive function in older adults.

LIFTS MOOD

The endorphins that result from a strength training session perk you up. It has also been shown that they reduce the likelihood that exercisers experience bouts of sadness compared with those not weight training.

STAVES OFF DEMENTIA

Strength training has been shown to raise levels of neurotrophins, which appear to lessen brain tissue loss and the lesions and plaques that are linked to conditions such as Alzheimer's disease.

CREATES MUSCLE MEMORY

Returning to the gym after a period away is made easier by your brain's memory of past movement patterns and tasks. Such memory helps improve the speed of recovery at the muscular level since less time is spent relearning the exercises.

ALLEVIATES STRESS AND ANXIETY

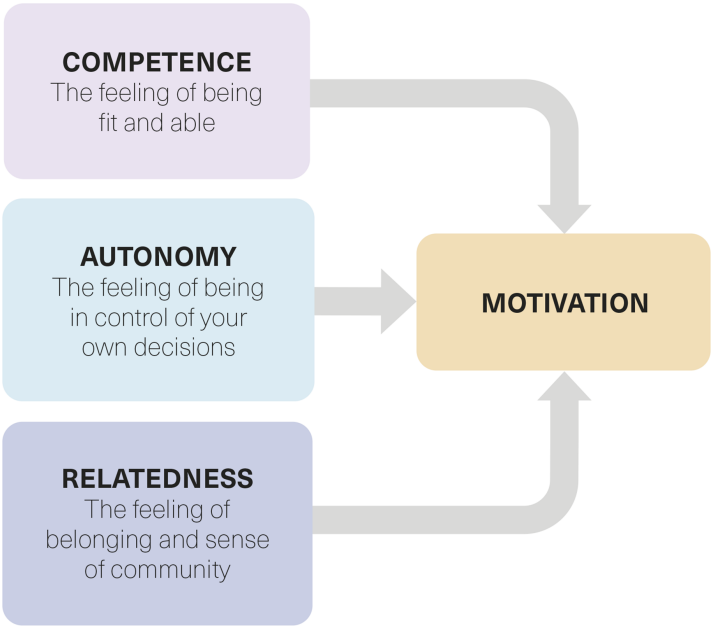
Training at the gym is often a social activity, which can ease stress. Plus, resistance training has been shown to significantly improve stress- and anxiety-related symptoms, both among healthy individuals and those people with a physical or a mental illness.

PSYCHOLOGICAL WINS

Use psychological techniques to discover what drives you to do strength training and to establish sustainable habits based around achieving goals in the long term. Think of goals as a way of setting a direction, but your daily habits are the system for making progress.

Find your motivation

Your basic psychological needs all feed into your motivation toward achieving a goal. But you also need to understand why you want to reach that goal. Motivation can be intrinsic (driven by basic needs; things that are satisfying; things that you're good at) and extrinsic (focussed on appeasing others). While you work toward your goals, it has been shown that extrinsic motivations fade while intrinsic motivations take over.

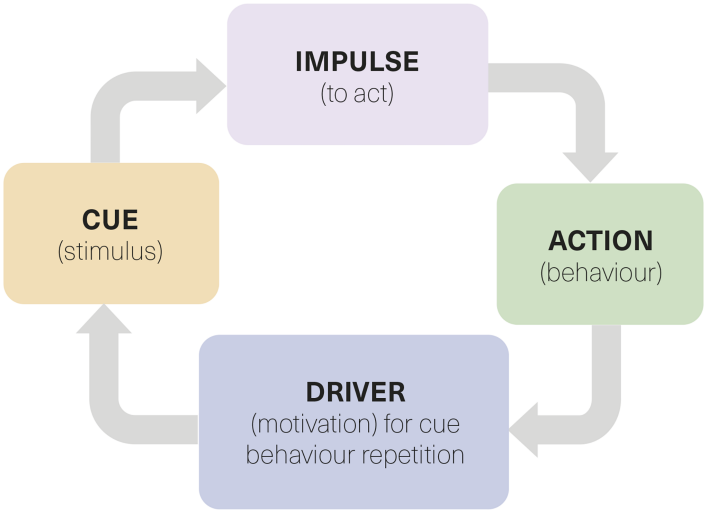


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Establish sustainable habits

Creating long-lasting routines and habits ensures you set yourself up for success and perform tasks without having to think much about them. The more you repeat the cycle, the more you will strengthen the bond between the cue and the action. At first, this process can be difficult but the more you execute this routine, the habit will form automatically. If you struggle to get started, keep in mind that it's

important to begin with small steps and to find something you enjoy doing.



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Set reliable goals

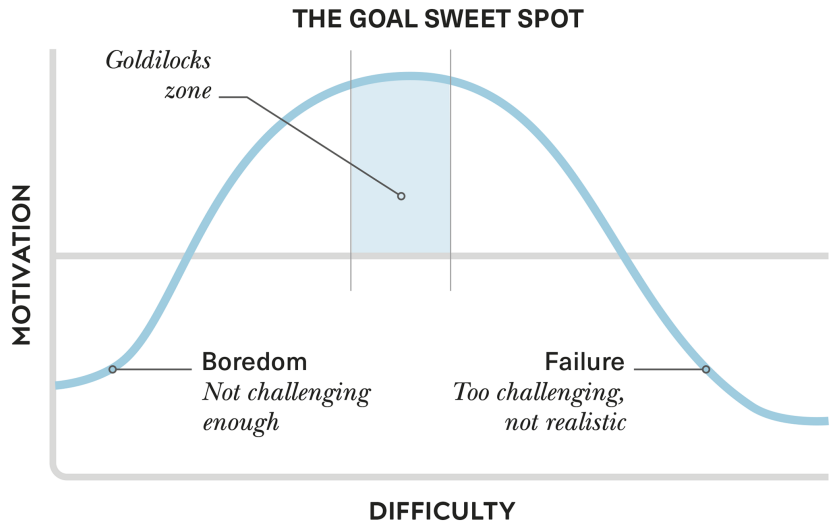
Once you've identified your motivations for creating change, it's important to understand how to set goals you can attain. Setting goals is known to be a positive contributor to achieving what you have set out to accomplish, while lowering the potential to be overwhelmed or discouraged. When setting a goal, you need to be sure it is SMART.

SMART goals work

The acronym SMART is useful to help you remember the characteristics of goal setting. For maximum success, a goal needs to be **S**pecific (identify what you would like to accomplish); **M**easurable (set a timeline and what you will track); **A**chievable (start slow and increase the intensity or commitment over time); **R**ealistic (consider the impact on your daily life); and **T**imely (start by setting an initial time frame for the goal).

THE RIGHT BALANCE

To hit the Goldilocks zone (not too hard, not too easy, just right), it's crucial to find the right level of challenge.



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◀ CONTENTS

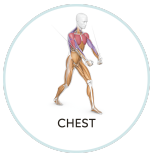


STRENGTH EXERCISES

When it comes to strength training, the goal is to get the maximum benefit from every workout. This section comprises 31 main exercises, many with additional variations to do at home or with different equipment, that show you how best to execute each movement to maximize the benefits while limiting the risk of injury. You'll find the best exercises to challenge each major muscle group of the body.



LEGS



CHEST



BACK



SHOULDERS



ARMS



ABDOMINALS

INTRODUCTION TO THE EXERCISES

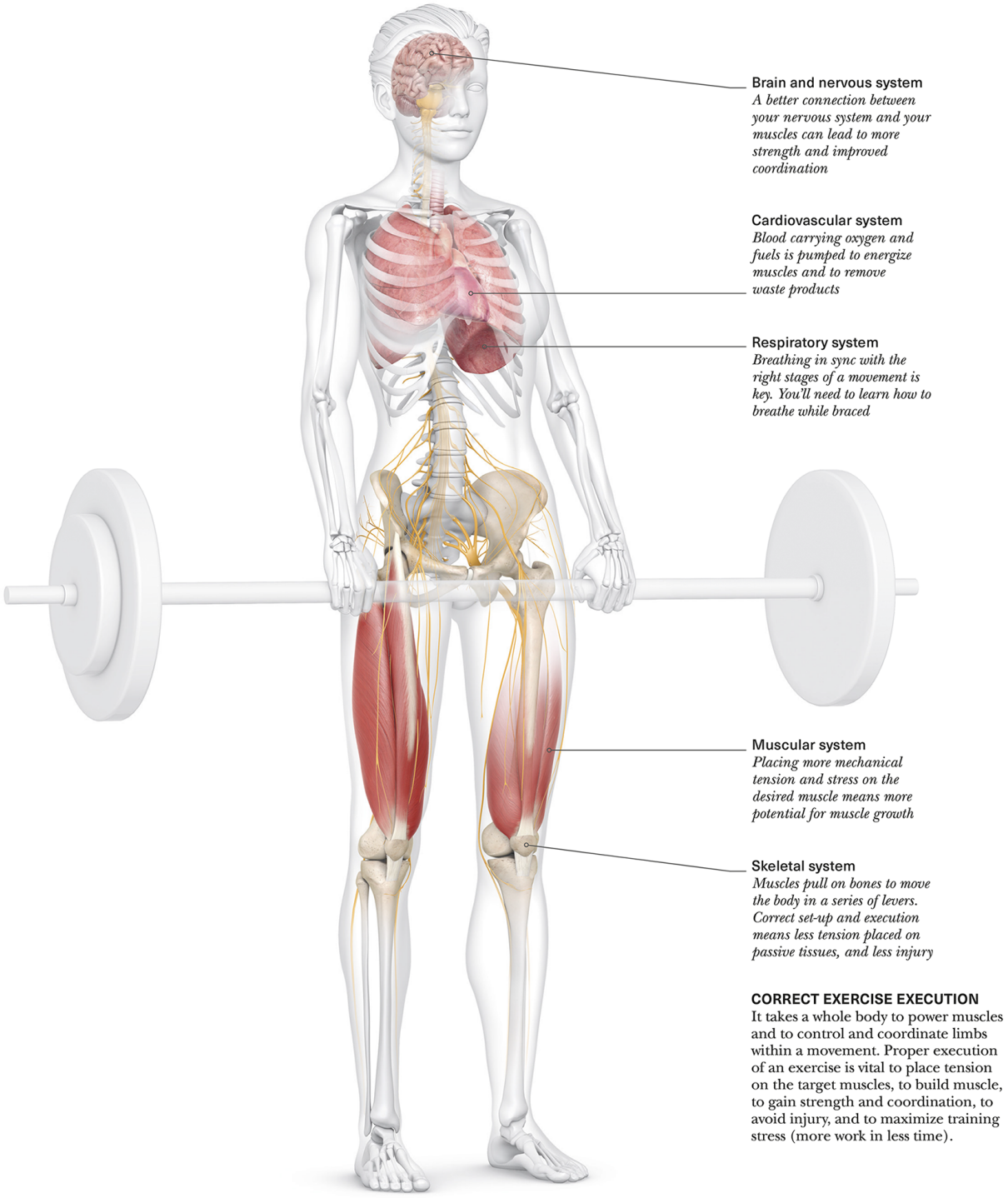
The exercises in this section show you how best to challenge a specific muscle group(s). But, first, find out the basics of proper execution, how to master breathing, and how to exercise safely wherever you choose to train – at home or in the gym.

MAINS AND VARIATIONS

The exercises are organized by muscle group, and further into "main" and "variation" exercises. Each main exercise has been chosen as an effective way to train specific muscle group(s), commonly using a multi-joint compound exercise. Each variation helps complement the main exercise, while adding new ways of challenging the muscle(s). The muscles used in each stage of a main exercise are illustrated anatomically, alongside the steps on how to best perform the movement. Exercises are also organized into goal-specific training programmes, where you can take what you learn from each structured grouping and apply it to an organized workout at the gym or at home.

CORRECT EXERCISE EXECUTION

It takes a whole body to power muscles and to control and coordinate limbs within a movement. Proper execution of an exercise is vital to place tension on the target muscles, to build muscle, to gain strength and coordination, to avoid injury, and to maximize training stress (more work in less time).



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Brain and nervous system

A better connection between your nervous system and your muscles can lead to more strength and improved coordination

Cardiovascular system

Blood carrying oxygen and fuels is pumped to energize muscles and to remove waste products

Respiratory system

Breathing in sync with the right stages of a movement is key. You'll need to learn how to breathe while braced

Muscular system

Placing more mechanical tension and stress on the desired muscle means more potential for muscle growth

Skeletal system

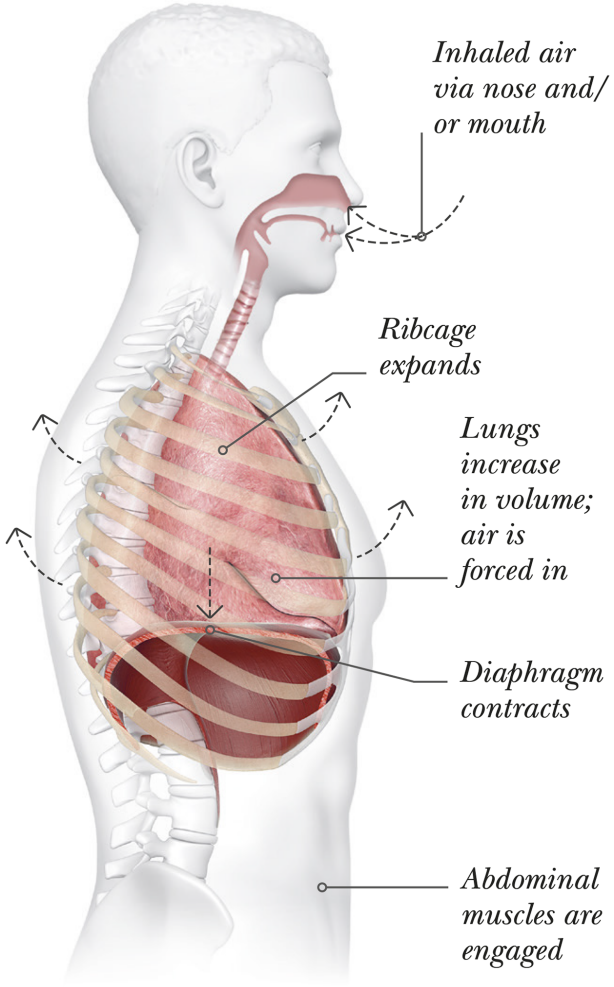
Muscles pull on bones to move the body in a series of levers. Correct set-up and execution means less tension placed on passive tissues, and less injury

Common mistakes

On most exercises there is a box relating to commonly seen errors when performing the exercise. As well as these prompts, it's also crucial not to obsess over details (what's known as "paralysis by analysis"); not to move loads without thought of the muscles being worked (intention and focus are key for mind–muscle connection); not to sacrifice execution or proper technique for a higher load on the bar or to adapt your form to make things easier (cheating reps).

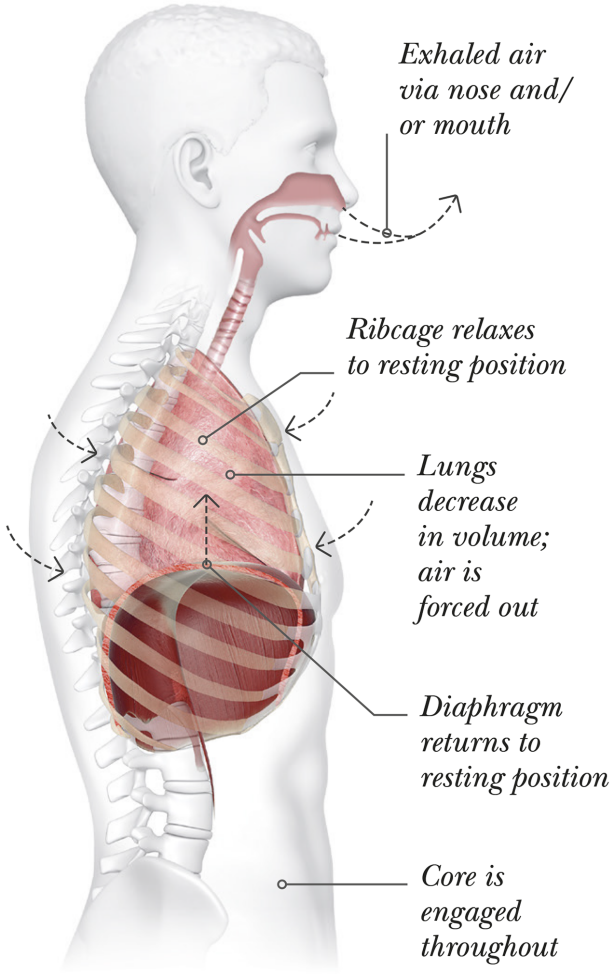
THE IMPORTANCE OF **BREATHING**

The respiratory and circulatory systems work to respond to the demands of the exercise to fuel the muscles. To maximize a workout's efficiency, it's key to engage your abdominal muscles throughout. Breathing instructions are given for all exercises, so you know during which stage of an exercise to breathe in and to breathe out.



Double-tap image to read the labels

BREATHING IN



Double-tap image to read the labels

BREATHING OUT

Exercise terminology

Knowing what terms mean is crucial to understanding instructions related to the exercises (see Variables within strength training and the glossary). The most important ones to learn from the start are explained here.

REPETITION (REP)

One completion of an exercise (concentric and eccentric, or vice versa). The number of reps is generally relative to the weight being lifted.

TRAINING VOLUME

Training volume refers to the amount of exercise or work performed over a given period of time, whether that's the training session or a week of training.

SET

A series of repetitions (or reps) performed sequentially – such as "3 sets of 6–8 reps". You'll find the suggested number of reps and sets to perform for each exercise listed within a goal-specific training programme.

TEMPO

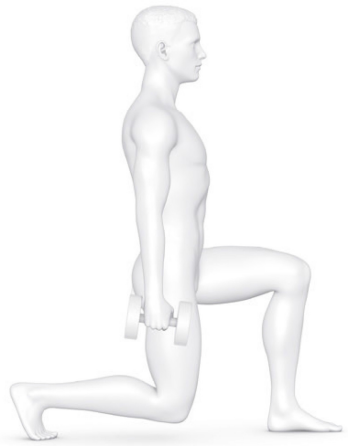
The speed at which you perform an exercise. The tempo should be controlled at all times, in both stages of the exercise.

WHERE TO TRAIN?

Unlike some types of exercise modalities, strength training provides flexibility to be done at the gym or from the comfort (and convenience) of your own home. Choosing the right environment to work out in can be important in avoiding somewhere you feel you do not belong, the feeling of intimidation or the worry around proper hygiene by those around you. Whether you like to train solely in the gym, always at home, or a mix of the two, it's good to know that you can progress toward your goals no matter where you choose to strength train.

At home

If your home has space for you to train, then it offers you the most customizable option in terms of equipment and facilities. Working out at home allows you to control the environment (room temperature and music, for instance), omits the potential of feeling intimidated (if that's a concern), and puts you in sole charge of proper gym hygiene and potential spread of germs.



Pros

The potential upsides of training at home are:

more exercises are possible – new innovations in multifunctional equipment, resistance bands, and free weights make training at home easier than ever

choosing your own playlist – motivate yourself through the music playing during workouts; the right music can motivate you to work harder.

working out any time – fancy a workout now? Then you can get set up and get straight to it.

Cons

The potential downsides of working out at home can be:

feeling unmotivated – it's easy not to feel the drive to push yourself during home-based workouts, plus you miss out on other social interactions

affordability of equipment – building up the kit you need to work out effectively can be expensive, though equipment has become more affordable

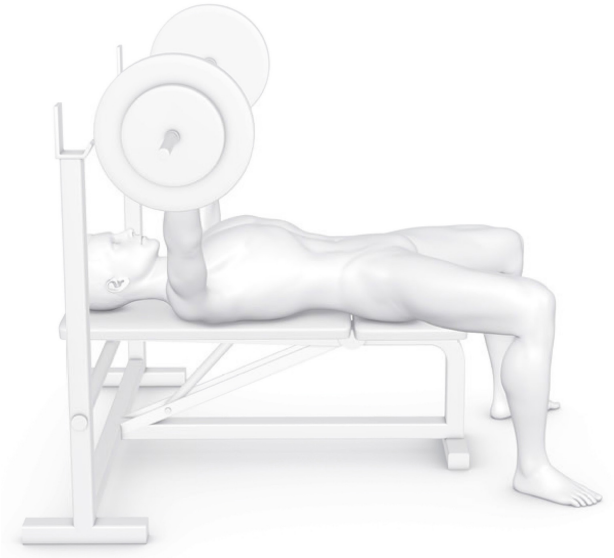
potential limits on resistance (weight) – free weights are available only up to a certain size, so you're limited to those you can buy and use.

Caution

If you have a pre-existing condition and any exercise in this section causes you pain, consult a qualified professional.

At the gym

The gym should be a warm, inviting, and motivating place to do a workout. That said, it's key to find a gym where you feel you belong and where you don't feel intimidated. If there isn't a gym nearby that you feel fits your preferences, training at home is a viable option.



Pros

The potential upsides of gym-based training are:

the greatest value in terms of equipment and facilities – a good gym has everything you need and more, including access to a personal trainer

a motivating environment – training in a gym can encourage you to push yourself

a more social set-up – you can form new relationships and be around others who are like-minded and have similar goals of improving their health and body composition.

Cons

The potential downsides can be:

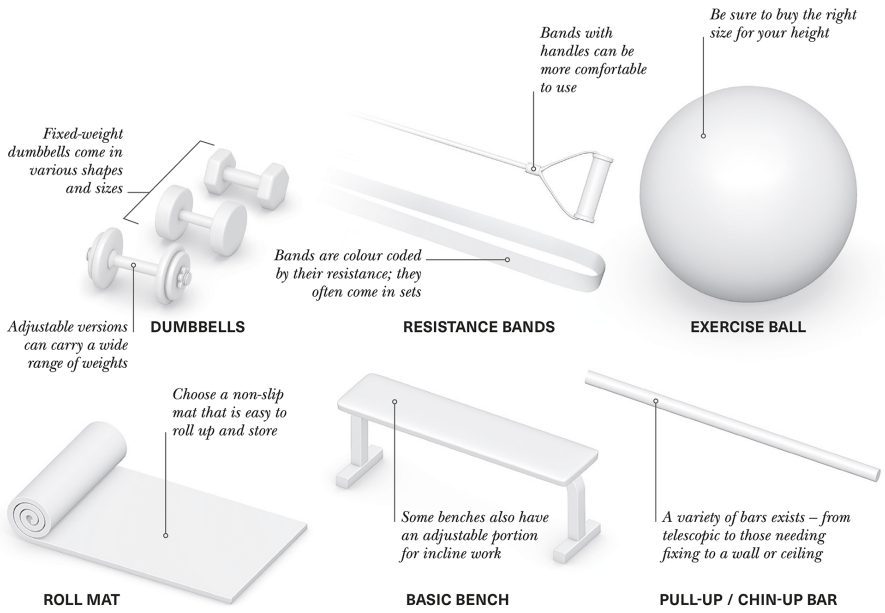
lack of control of the environment – working out with others has social advantages but if the music is limited (or annoying) and the gym is too hot or too cold, this can throw off the experience

feelings of intimidation – it may be due to inexperience or the attitudes of others but if you feel intimidated, find another gym instead

gym hygiene – you need to be happy with the cleanliness and measures taken to prevent germ transmission.

At-home training kit

Training at home has never been easier with the advent of more-affordable multifunctional equipment. You may not want to buy all of the items listed below, but if you do you'll be well on your way to be able to perform most of the exercises in the comfort of your own home.



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Good gym etiquette

When training in a public place, such as a gym, it's important to be respectful of others. Here are just a few things to be aware of that can keep a harmonious atmosphere and make others see that you are taking consideration of them.

Re-rack weights after use

Don't leave weights on the floor. Re-rack barbells and remove weights to the stack and clean down ready for the next person.

Be aware of others using equipment

Find out who's queueing for a particular machine or piece of equipment. Do not take over someone's claimed machine.

Be socially aware

Respect boundaries, personal space, and eye contact. Get a sense for the feel of the gym and act appropriately.

If taking a photo or video,

Ensure the gym's policy allows you to do so; if in doubt, ask the management as well as the permission of those around you.

Share equipment equally

Respect others and do not overstay your welcome at specific machines or stations, especially if the gym is busy.

Wear headphones if listening to music

Keep your music to yourself. Loud music from a speaker can interrrupt and irritate those working out around you.

Extra-special measures

Cleaning equipment or weights after use was always part of a gym's protocol. But now, due to health concerns across the globe, gyms are required to take cautious measures to ensure the health and safety of their members and help prevent the spread of disease. Be sure to wipe down equipment before and after use, cover all coughing and sneezes, wash hands often (or use hand sanitizer), do not share towels or drinks with others, and do not go to the gym if you feel unwell.

CHOOSING **WEIGHTS**

When you first join a gym, you will be given an induction on how to safely use all the equipment. Understanding how to choose weights (load selection) to best fit your structure can impact on the safety and efficacy of your lifting. Start each exercise with a light weight that you know you can lift easily and progress the weight based on assessment and the desired rep range.

Machines

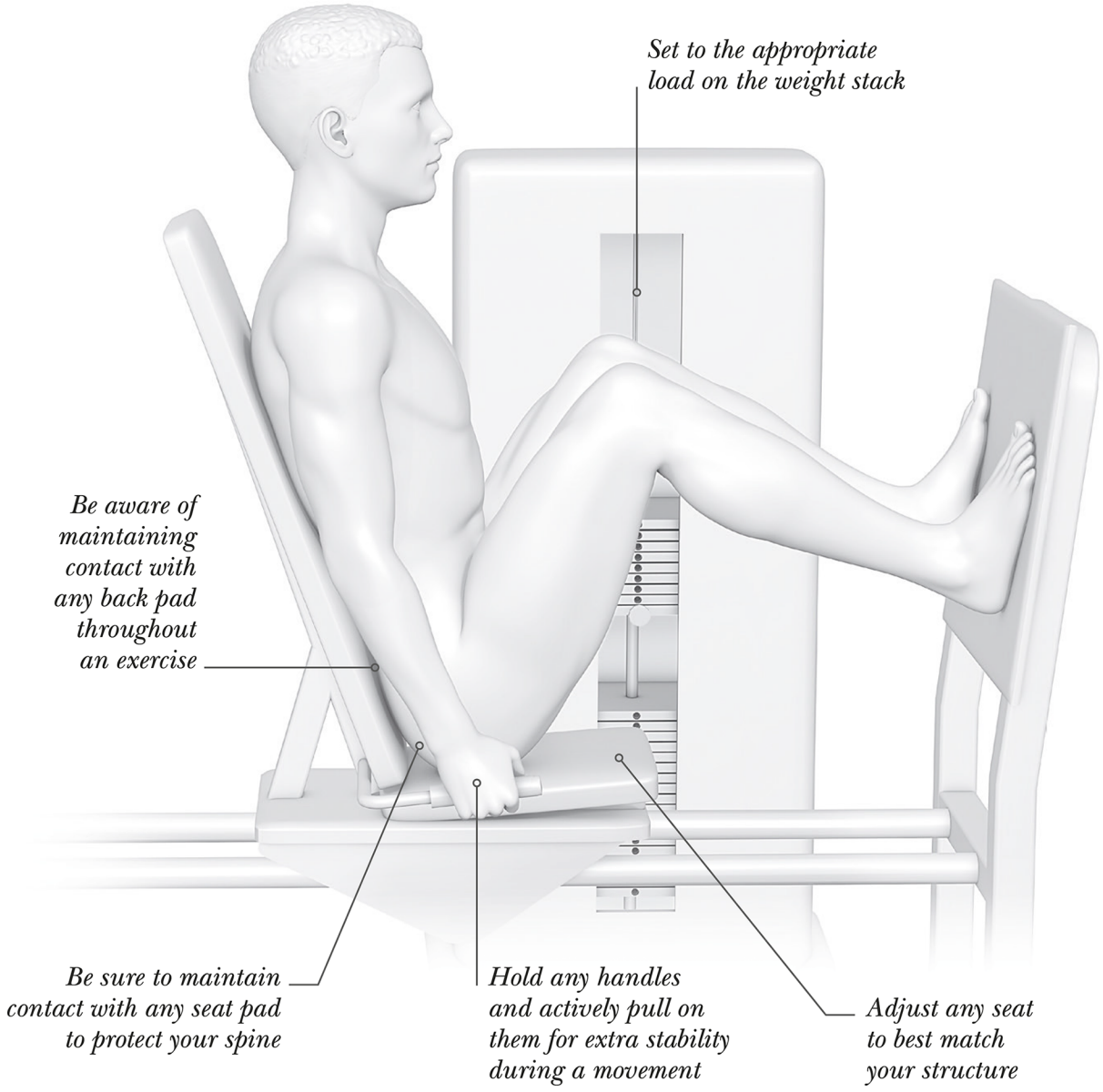
You will likely see machines of two different styles: the "selectorize" machines are loaded with a pin system; the "plate-loaded" ones use weight plates on designated horns – the same plates used on a barbell. Machines that focus on large muscle groups (legs, chest, and back) typically have heavier weight stacks compared with machines that focus on smaller muscle groups (arms, shoulders, and calf). If you are unsure of what is "light enough", start by placing the selectorize pin in the first slot and perform one rep.

Free weights

Free weights include barbells and dumbbells. Barbells are commonly 20kg (45lb), 28.5mm ($1\,{}^{1}\!/_{10}$in) in diameter, and 2.15m (85in) in length; shorter ones are sometimes available. When loading a barbell, slide the plates on and lock with a clip or collar. The weight of a dumbbell is identified by its label. Dumbbells are typically found in pairs (two of the same weight and size). Start with a weight you know you can lift for the designated rep range. If new to barbells, start with the bar only and increase weight (in 2.25–4.5kg/5–10lb increments).

WORKING ON **MACHINES**

Each machine will need to be adjusted to best fit your individual structure. It's a good idea if you are new to training with machines to have a session with a trainer to learn how each machine works and what settings are best for you. The most common adjustments are for the seat pad, back pad, and thigh pad; but also do note any axis of rotations on the machine to best line up your legs. If something feels uncomfortable when you perform your first reps, adjust the available settings until the exercise feels comfortable.



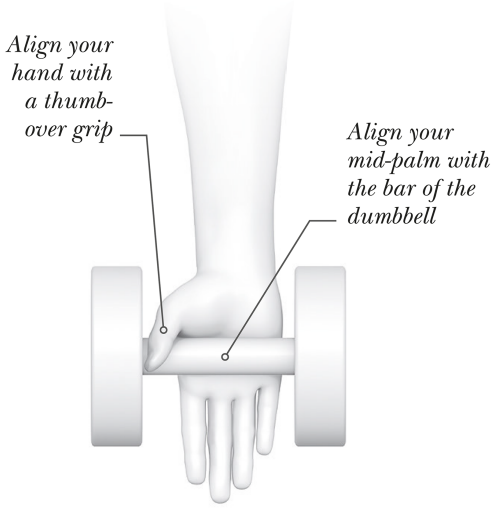
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LIFTING **SAFELY**

Arguably the most important component of strength training is safety. Lifting weights safely takes constant thought and attention to what you are doing, whether you are training in the gym or working out at home. Such focus on execution of an exercise not only keeps you safe, but also ensures you're able to work out sustainably within your regular programme. Grip is key – both in how you hold a weight (a barbell or dumbbell) and in how far apart your hands are when performing an exercise.

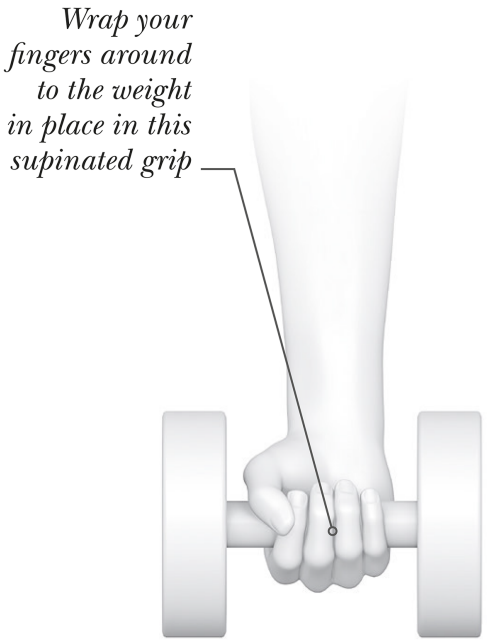
How to grip

Gripping the bar in a certain way is essential for securely holding the weight in whatever position is needed and for limiting any soreness in your hands. Common grips are supinated, neutral, and pronated (see Position the Bar, and the wrist); semi-supinated is halfway between a supinated and a neutral position.



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POSITION THE BAR

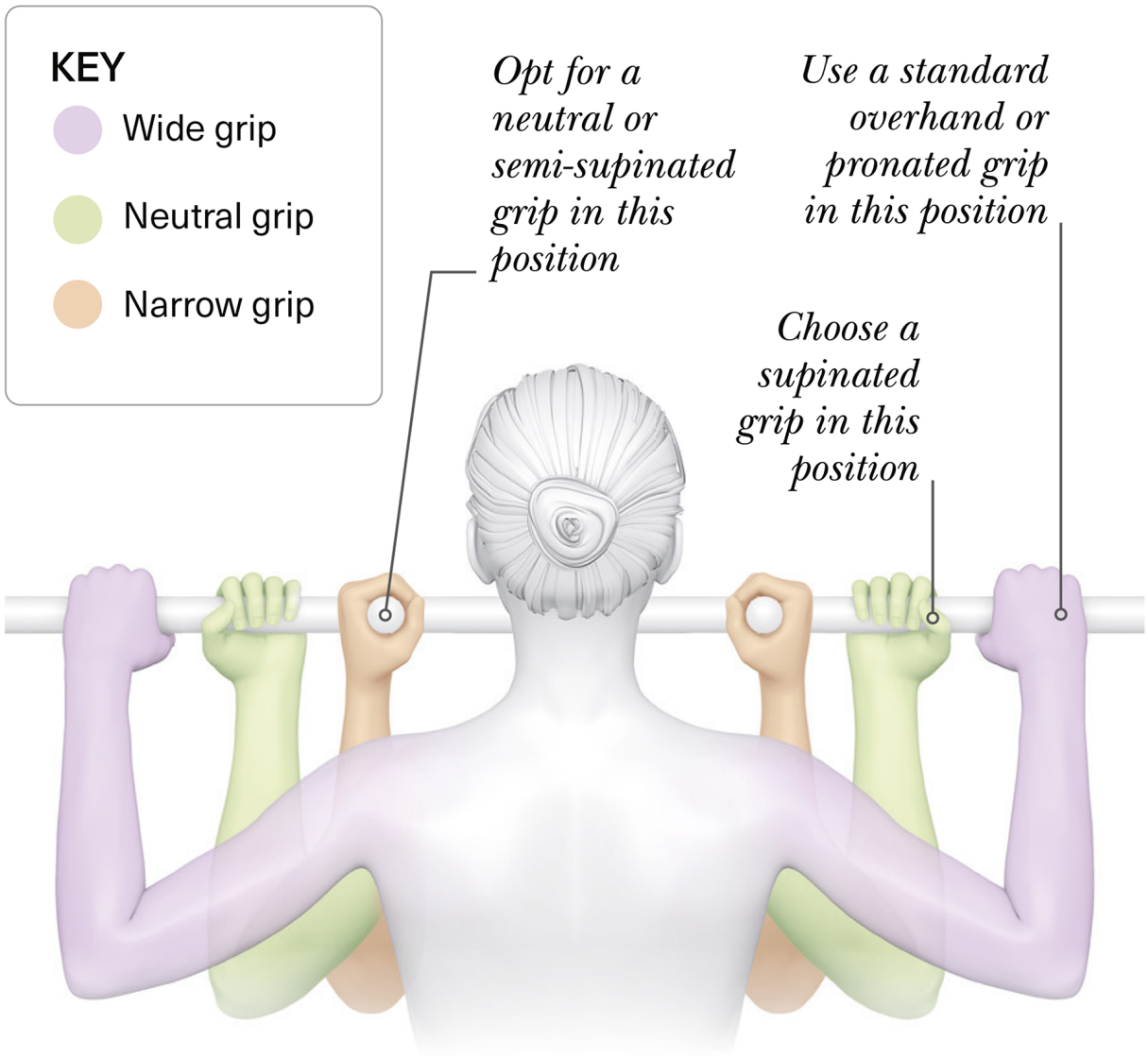


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GRIP THE BAR

Grip positions and types

Like other parts of the set-up, the width of grip you use on a bar or a machine attachment (see Wide-grip Vertical pulldown), as well as your wrist's position, directly impacts which muscles have more leverage and can best contribute to the movement. So, switching from a wide to a narrow or neutral grip for the same exercise targets slightly different muscles.



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Log your workouts

Keeping notes on each workout helps you track and maintain progress; for example, you can see at a glance the weight used last week for an exercise and can increase accordingly, unless it was flagged as too challenging. Keeping a log – whether it's an actual book, a spreadsheet, or an app – is a good habit to get into. The table, shown here, gives you an idea of the details you need to track.

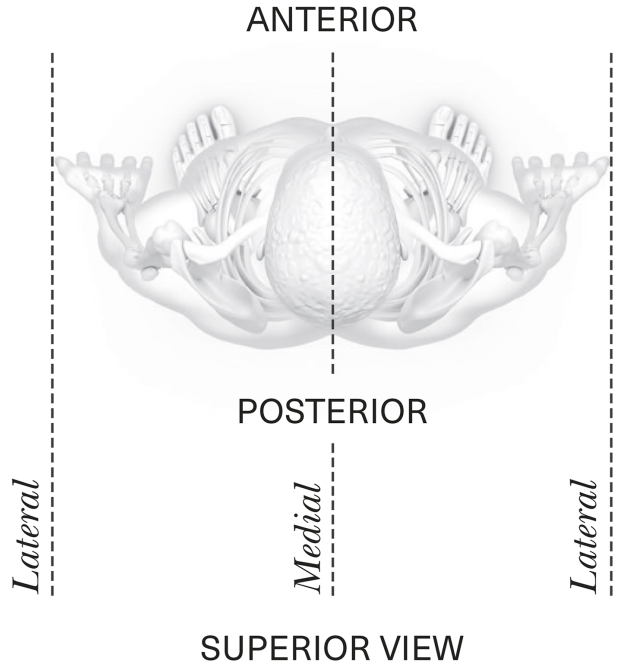
WORKOUT DATE

EXERCISE	REPS AND SETS	WEIGHT USED PER SET	REST	NOTES
LEG PRESS	4 sets of 10 reps	Set 1 XXkg/lb	60 seconds	Go up in weight next week by XXkg/lb
SHOULDER PRESS	4 sets of 10 reps	Set 1 XXkg/lb	60 seconds	Challenging; stay with same weight next time

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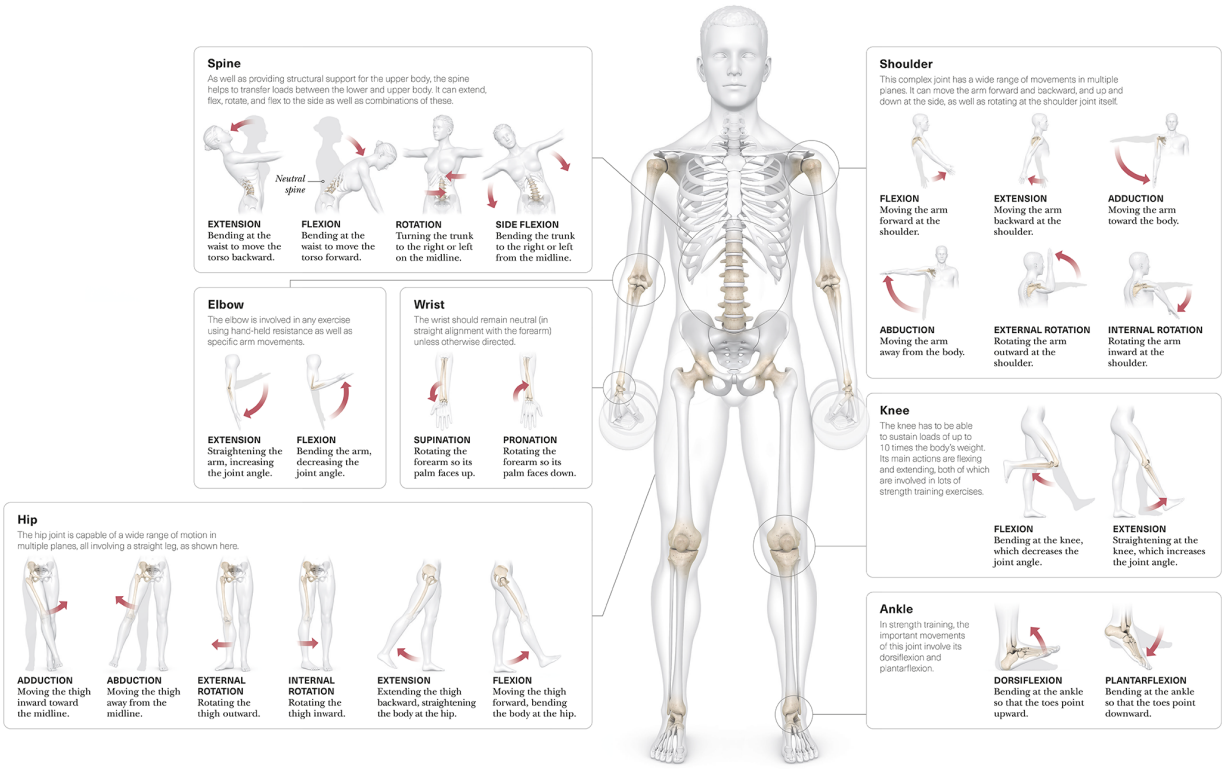
TERMINOLOGY GUIDE

The body's joints facilitate an incredible and wide range of movements, and each movement is described using the illustrations on these pages. Throughout this book, instructions use terminology and directional terms that will help guide you in a specific stage of an exercise or the exercise as a whole, so it's a good idea to mark this page for easy reference.



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ORIENTATIONS



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Shoulder

This complex joint has a wide range of movements in multiple planes. It can move the arm forward and backward, and up and down at the side, as well as rotating at the shoulder joint itself.

FLEXION

Moving the arm forward at the shoulder.



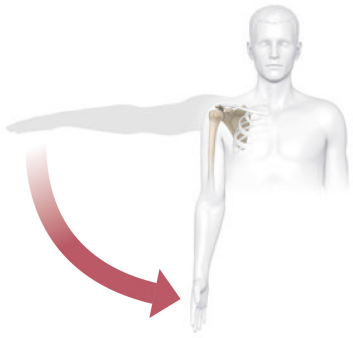
EXTENSION

Moving the arm backward at the shoulder.



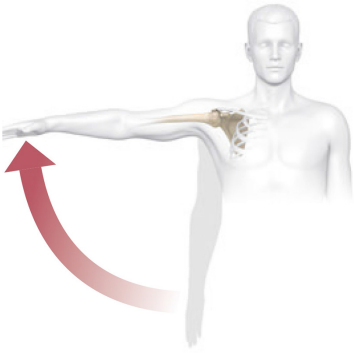
ADDUCTION

Moving the arm toward the body.



ABDUCTION

Moving the arm away from the body.



EXTERNAL ROTATION

Rotating the arm outward at the shoulder.



INTERNAL ROTATION

Rotating the arm inward at the shoulder.

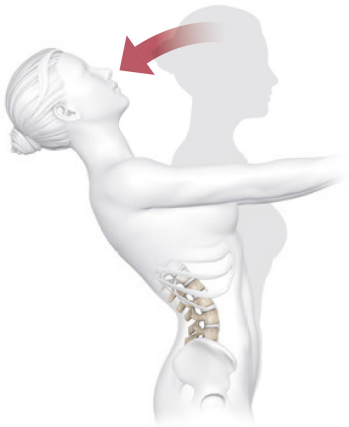


Spine

As well as providing structural support for the upper body, the spine helps to transfer loads between the lower and upper body. It can extend, flex, rotate, and flex to the side as well as combinations of these.

EXTENSION

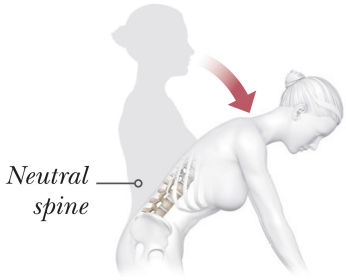
Bending at the waist to move the torso backward.



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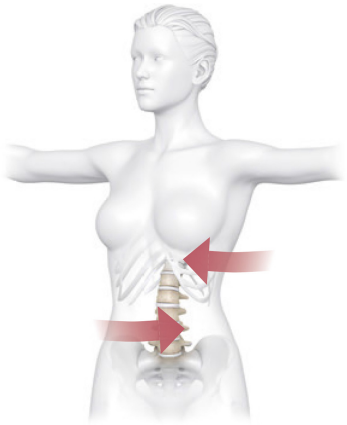
FLEXION

Bending at the waist to move the torso forward.



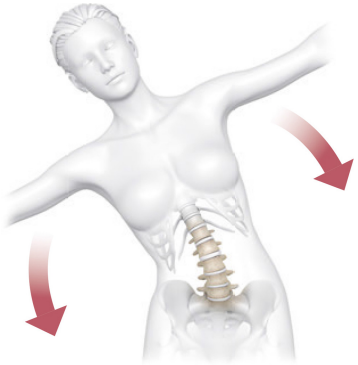
ROTATION

Turning the trunk to the right or left on the midline.



SIDE FLEXION

Bending the trunk to the right or left from the midline.



Elbow

The elbow is involved in any exercise using hand-held resistance as well as specific arm movements.

EXTENSION

Straightening the arm, increasing the joint angle.



FLEXION

Bending the arm, decreasing the joint angle.

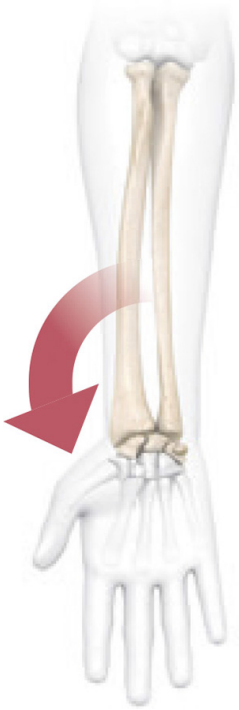


Wrist

The wrist should remain neutral (in straight alignment with the forearm) unless otherwise directed.

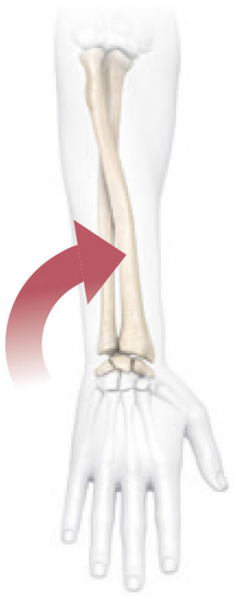
SUPINATION

Rotating the forearm so its palm faces up.



PRONATION

Rotating the forearm so its palm faces down.

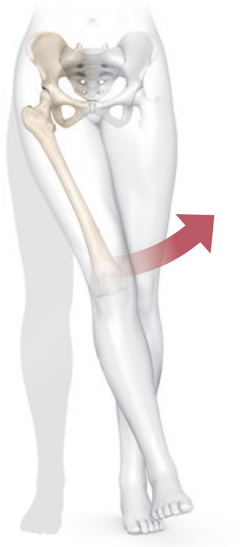


Hip

The hip joint is capable of a wide range of motion in multiple planes, all involving a straight leg, as shown here.

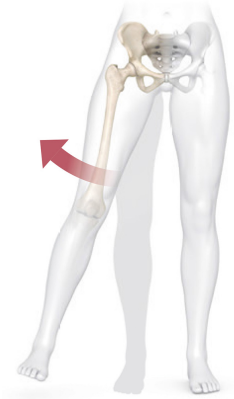
ADDUCTION

Moving the thigh inward toward the midline.



ABDUCTION

Moving the thigh away from the midline.



EXTERNAL ROTATION

Rotating the thigh outward.



INTERNAL ROTATION

Rotating the thigh inward.



EXTENSION

Extending the thigh backward, straightening the body at the hip.



FLEXION

Moving the thigh forward, bending the body at the hip.



Knee

The knee has to be able to sustain loads of up to 10 times the body's weight. Its main actions are flexing and extending, both of which are involved in lots of strength training exercises.

FLEXION

Bending at the knee, which decreases the joint angle.



EXTENSION

Straightening at the knee, which increases the joint angle.



Ankle

In strength training, the important movements of this joint involve its dorsiflexion and plantarflexion.

DORSIFLEXION

Bending at the ankle so that the toes point upward.



PLANTARFLEXION

Bending at the ankle so that the toes point downward.



LEG EXERCISES

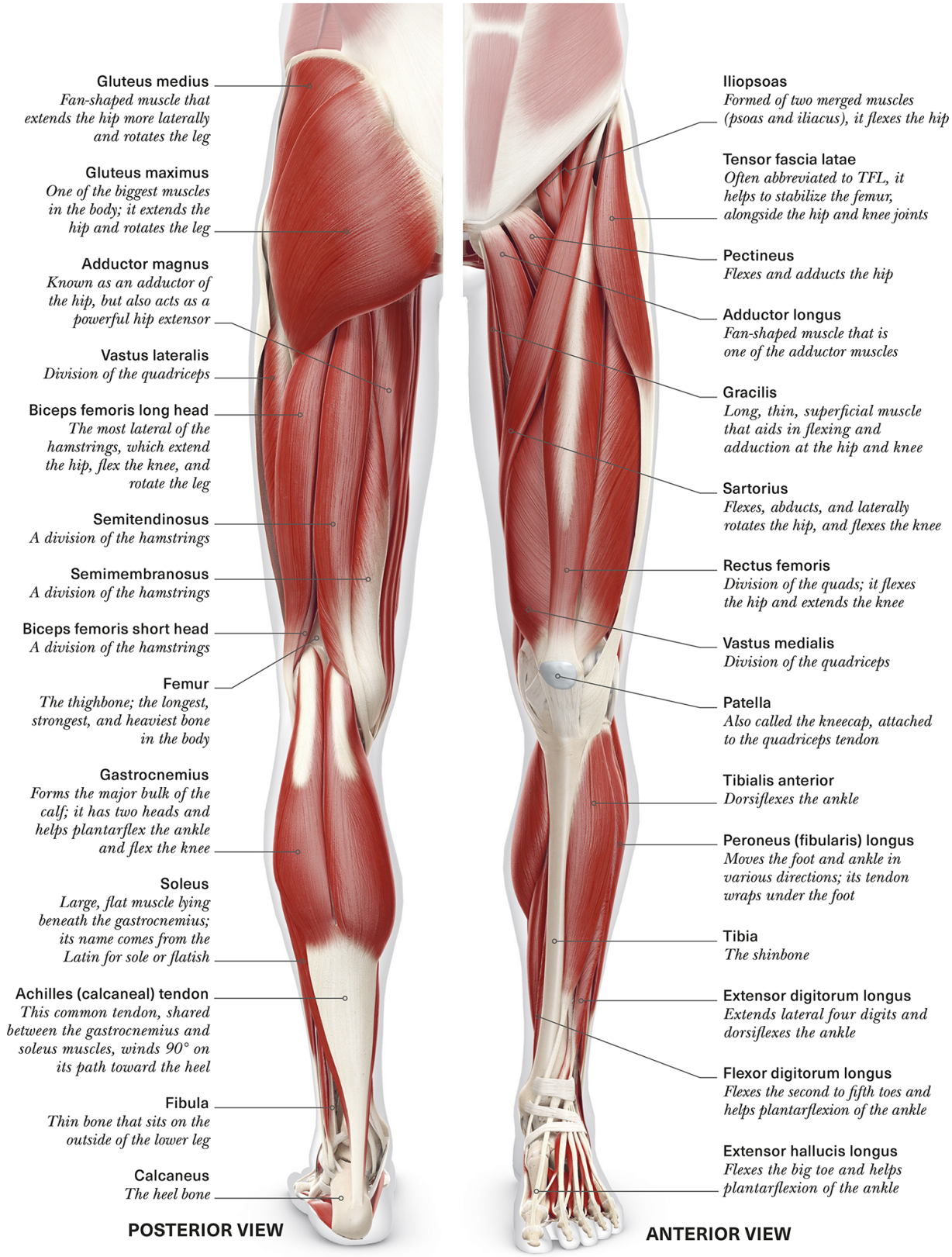
The main muscle groups responsible for movement of the lower body are: the quadriceps, the muscles that give the upper front leg its shape; the hamstrings, the equivalent muscle group at the back of the upper leg; the gluteal muscles, resting on the back of the pelvis; and the calves, at the back of the lower leg.

The main role of the quadriceps (or quads) is to extend the knee, with one division (rectus femoris) specifically also enabling hip flexion. Hamstrings, meanwhile, extend the hips and flex the knee. The glutes work to extend the hips, as well as aiding internal and external rotation of the leg at the hip. The calves mainly plantarflex the ankle and flex the knee.

Within lower-body training, multiple muscle groups combine to help coordinate movement around the hip, knee, and ankle joints.

When performing compound exercises (which involve more than one joint) you will be using muscles across the lower body to perform the movement while controlling the forces around each joint. Examples include back squats and deadlifts.

When performing isolation exercises (which involve only one joint) you will be biasing one muscle group over others. You still use other muscles, though – to stabilize the forces around the working joint. Examples are leg extensions and calf raises.



Double-tap image to read the labels

POSTERIOR VIEW

Gluteus medius
Fan-shaped muscle that extends the hip more laterally and rotates the leg

Gluteus maximus
One of the biggest muscles in the body; it extends the hip and rotates the leg

Adductor magnus
Known as an adductor of the hip, but also acts as a powerful hip extensor

Vastus lateralis
Division of the quadriceps

Biceps femoris long head
The most lateral of the hamstrings, which extend the hip, flex the knee, and rotate the leg

Semitendinosus
A division of the hamstrings

Semimembranosus
A division of the hamstrings

Biceps femoris short head
A division of the hamstrings

Femur
The thighbone; the longest, strongest, and heaviest bone in the body

Gastrocnemius
Forms the major bulk of the calf; it has two heads and helps plantarflex the ankle and flex the knee

Soleus
Large, flat muscle lying beneath the gastrocnemius; its name comes from the Latin for sole or flatish

Achilles (calcaneal) tendon
This common tendon, shared between the gastrocnemius and soleus muscles, winds 90° on its path toward the heel

Fibula
Thin bone that sits on the outside of the lower leg

Calcaneus
The heel bone

ANTERIOR VIEW

Iliopsoas
Formed of two merged muscles (psoas and iliacus), it flexes the hip

Tensor fascia latae
Often abbreviated to TFL, it helps to stabilize the femur, alongside the hip and knee joints

Pectineus
Flexes and adducts the hip

Adductor longus
Fan-shaped muscle that is one of the adductor muscles

Gracilis
Long, thin, superficial muscle that aids in flexing and adduction at the hip and knee

Sartorius
Flexes, abducts, and laterally rotates the hip, and flexes the knee

Rectus femoris
Division of the quads; it flexes the hip and extends the knee

Vastus medialis
Division of the quadriceps

Patella
Also called the kneecap, attached to the quadriceps tendon

Tibialis anterior
Dorsiflexes the ankle

Peroneus (fibularis) longus
Moves the foot and ankle in various directions; its tendon wraps under the foot

Tibia
The shinbone

Extensor digitorum longus
Extends lateral four digits and dorsiflexes the ankle

Flexor digitorum longus
Flexes the second to fifth toes and helps plantarflexion of the ankle

Extensor hallucis longus
Flexes the big toe and helps plantarflexion of the ankle

*“Building muscle and **strength in your legs** can **improve your performance** across workouts.”*

SECTION CONTENTS

Barbell back squat

Variations:

- Dumbbell goblet squat
- Dumbbell squat
- Barbell front squat

Leg press

Hack squat

Stationary lunge with dumbbells

Variations:

- Front foot elevated split squat
- Back foot elevated split squat
- Walking lunge with dumbbells

Step up with dumbbells

Leg curl

Variations:

- Seated unilateral banded leg curl
- Seated leg curl
- Standing unilateral leg curl

Hamstring ball curl

Leg extension

Variations:

- Unilateral leg extension
- Unilateral cuffed leg extension
- Banded lying leg extension

Barbell glute bridge

Variations:

- Dumbbell glute bridge
- Standing cable glute kickback
- Single-leg glute bridge

Calf raise

Variations:

- Seated calf raise
- Single-leg calf raise
- Leg press calf raise

Traditional deadlift

Variations:

- Banded deadlift
- Trap bar deadlift
- Romanian deadlift
- Cable deadlift

BARBELL BACK SQUAT

This multi-joint exercise – also known as a compound exercise – helps to strengthen the quadriceps, adductors, and glutes; it also challenges the hamstrings, spinal erectors, and abdominals. Maintaining the correct form is key to protect the spine from injury.

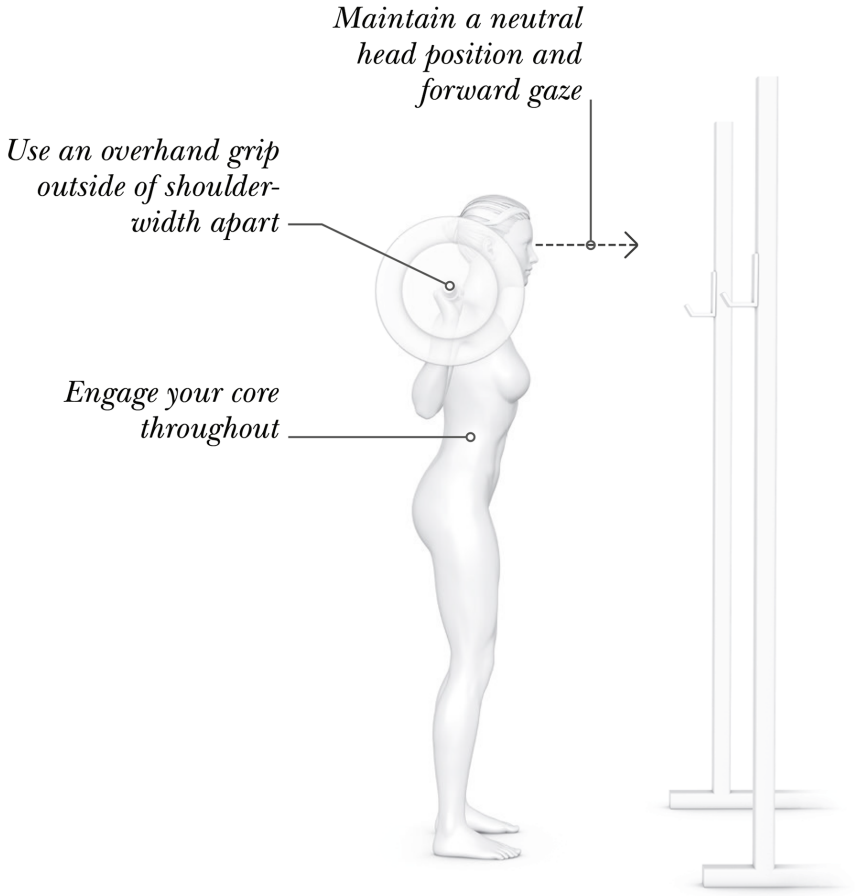
THE BIG PICTURE

Proper coordination and mechanics are crucial here. Engaging the core increases stability and control and prevents lower-back strain. Start off with a low weight and only increase the load when you're comfortable with the move.

Beginners can start with 4 sets of 8–10 reps; discover other variations and other targeted sets in the training programmes.

PREPARATORY STAGE

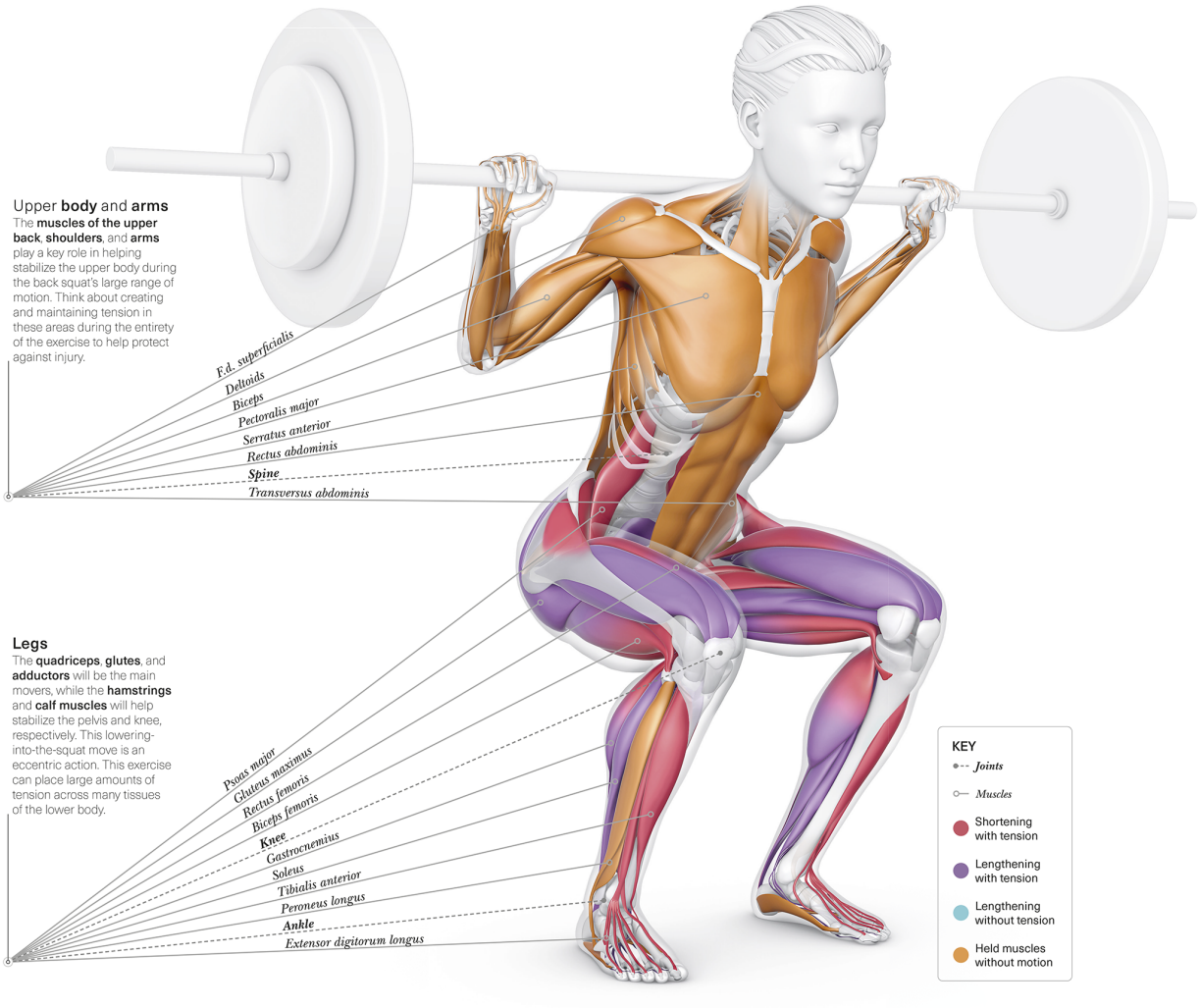
Unrack the bar and stand with it resting on the tops of your shoulders. Push down into the floor to prepare your spine. Take small steps back, one foot at a time, to get into the starting position, feet shoulder-width apart.



Double-tap image to read the labels

STAGE ONE

Breathe in and, with core engaged, push your hips back to begin the squat. Flex at your knees, keeping them in line with your feet as they move forward. Slow down as you approach the bottom position; your thighs should be roughly parallel with the floor.



ℹ Double-tap image to read the labels

ANTERIOR-LATERAL VIEW

Upper **body** and **arms**

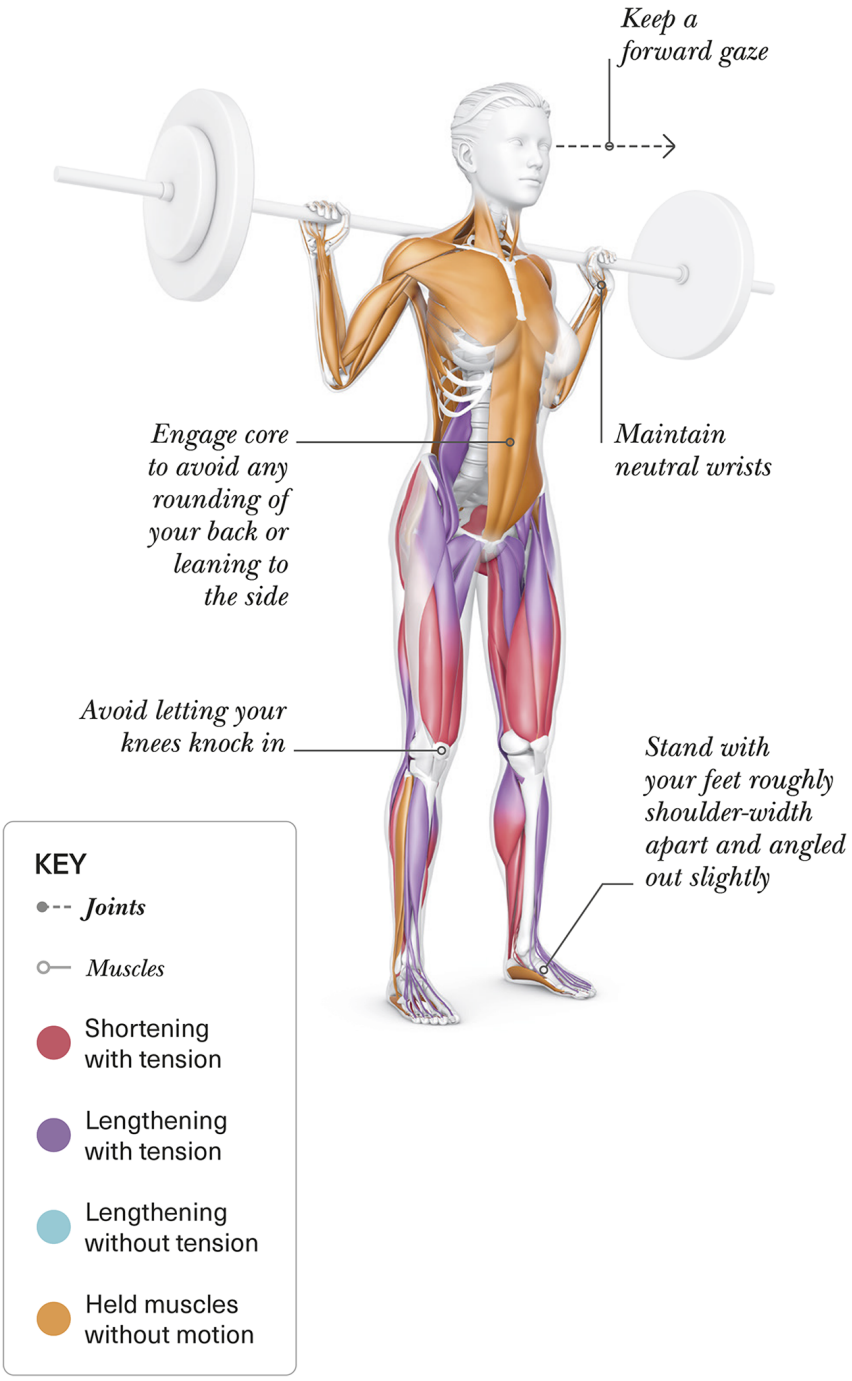
The **muscles of the upper back**, **shoulders**, and **arms** play a key role in helping stabilize the upper body during the back squat's large range of motion. Think about creating and maintaining tension in these areas during the entirety of the exercise to help protect against injury.

Legs

The **quadriceps**, **glutes**, and **adductors** will be the main movers, while the **hamstrings** and **calf muscles** will help stabilize the pelvis and knee, respectively. This lowering-into-the-squat move is an eccentric action. This exercise can place large amounts of tension across many tissues of the lower body.

STAGE TWO

With your core engaged, breathe out to push against the floor, keeping your spine neutral as you extend your legs at the hips and knees to return to the starting point. Reset your breathing, and pause at the top of the rep. Repeat stages 1 and 2.



Double-tap image to read the labels

VARIATIONS

While all use a squatting movement that targets the glutes and quads along with the hamstrings, these variations to the barbell back squat use weights held in different ways to offer an easier version or one that challenges other muscles more. Master your squatting execution first with the dumbbell squats, before tackling the barbell front squat.

DUMBBELL GOBLET SQUAT

Without the need for a barbell, this variation can be done at home. If you are new to squatting, start with this easier version. Holding a weight at the front skews the load to the upper back and allows the torso to be more upright.

PREPARATORY STAGE

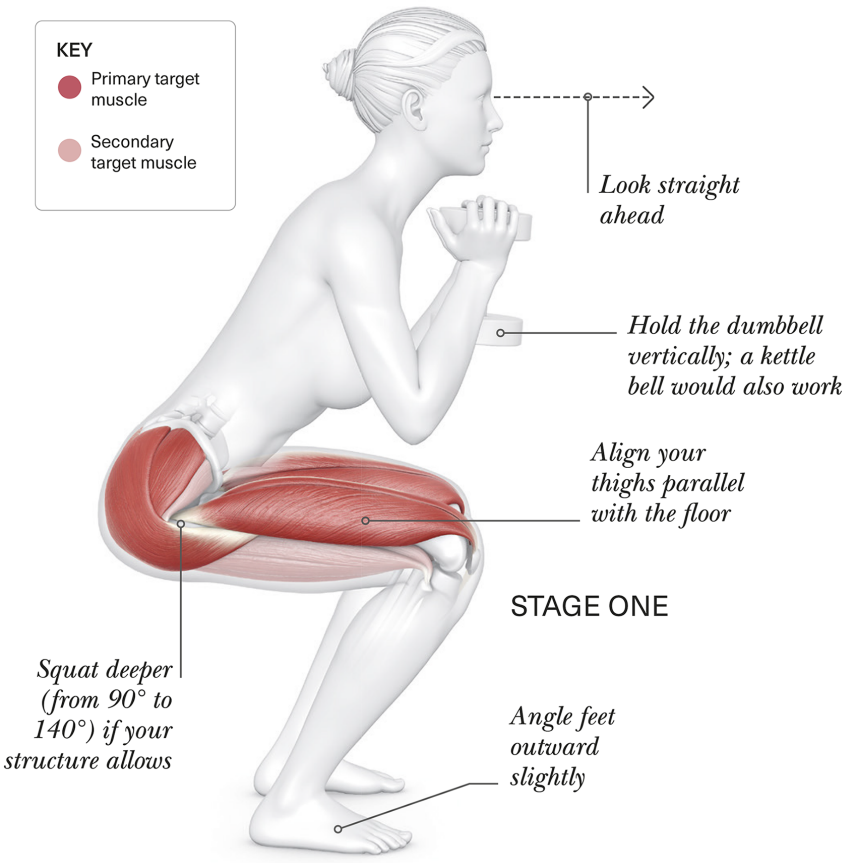
Plant your feet shoulder-width apart. With both hands, hold the dumbbell in front of your chest, under your chin. Keep your forearms near vertical.

STAGE ONE

Breathe in and push your hips back, bending at the knee and squatting deeply. Keep your knees wide, tracking in line with your toes; don't let them knock in.

STAGE TWO

Drive out of the squat to return to the standing position, breathing out as you do so. Keep your abs engaged throughout. Repeat stages 1 and 2.



Double-tap image to read the labels

DUMBBELL SQUAT

Using a pair of dumbbells, this squatting movement offers another easier variation. Holding the weights at your sides and naturally carrying them into the squat offers more work for muscles of the forearms, arms, and upper back.

PREPARATORY STAGE

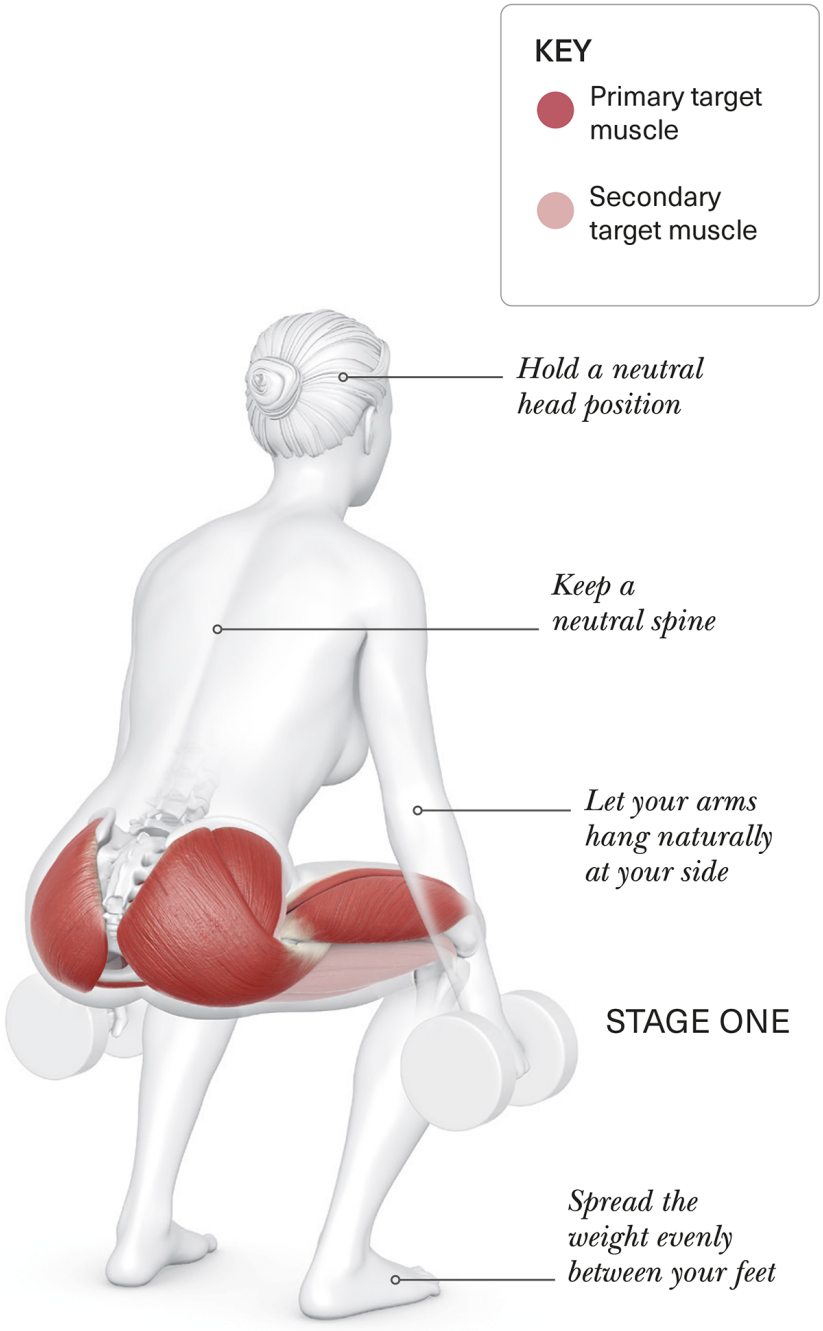
Stand tall with your feet roughly shoulder-width apart and parallel. Hold the dumbbells with straight arms at your sides. Look ahead and tense your torso.

STAGE ONE

With core engaged, breathe in and flex at the hips and knees to squat, with knees aligned over feet. Look ahead and keep your arms hanging vertically.

STAGE TWO

Breathe out as you drive out of the squat to return to the standing position, keeping your abs engaged at all times. Repeat stages 1 and 2.



Double-tap image to read the labels

BARBELL **FRONT SQUAT**

If you find the barbell back squat aggravates your lower back or you have a shoulder injury, this variation might suit you instead. This version challenges the muscles of the upper back more due to the load shifting from back to front.

PREPARATORY STAGE

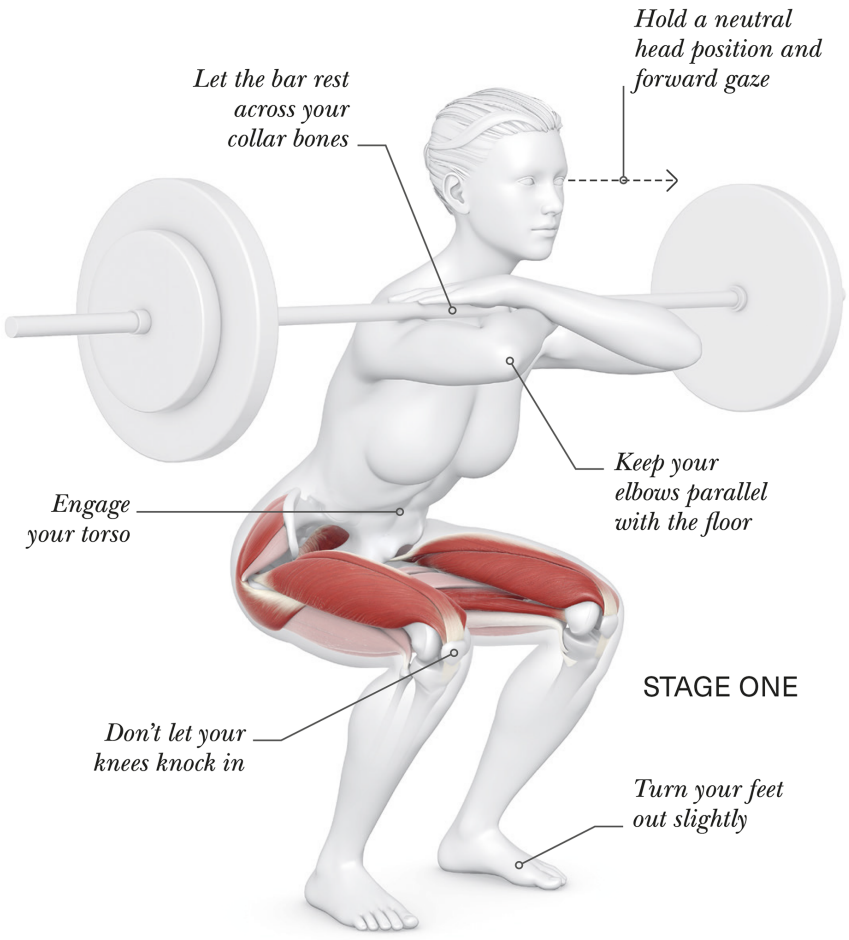
Stand tall with your feet roughly shoulder-width apart. Lift the barbell and allow it to settle at the top of your shoulders in line with your collar bones.

STAGE ONE

Breathe in, engage your core, and "sit" into a deep squat, keeping your torso as upright as possible. Hold a forward gaze and keep the barbell still.

STAGE TWO

Breathe out as you push through your feet and stand up, extending your legs at the hip and knee with your core engaged. Repeat stages 1 and 2.

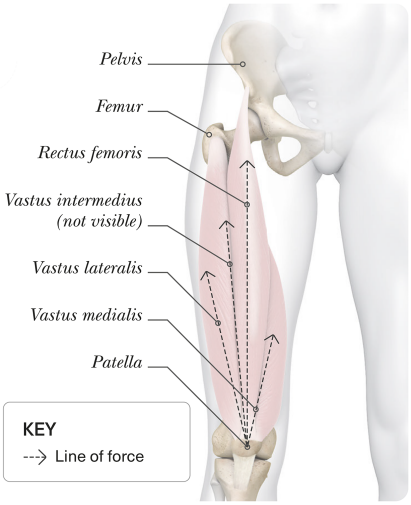


Double-tap image to read the labels

*"Squatting is a **multi-joint exercise** that challenges muscles around the knee, hip, and torso; improved **mobility** and **balance** and **stronger muscles** benefit day-to-day life."*

Force lines in the **quadriceps**

The quadriceps is not one muscle but several divisions of muscle working together; these divisions have varying lines of force, or pull, depending on when they are most needed throughout a range of motion of an action. For example, in a squat exercise, different divisions of the quadriceps come into play more at particular points of the squatting movement. Overall, then, the divisions of the quadriceps work in synchronicity.



Double-tap image to read the labels

ANTERIOR VIEW

LEG PRESS

This straightforward movement works a wide range of leg muscles. The machine-based leg press helps strengthen the quadriceps, adductors, and glutes, while also challenging the hamstrings. This compound movement mimics the back squat but without the need to load the spine, so it's particularly good for protecting against injury or helping to work around pre-existing injuries.

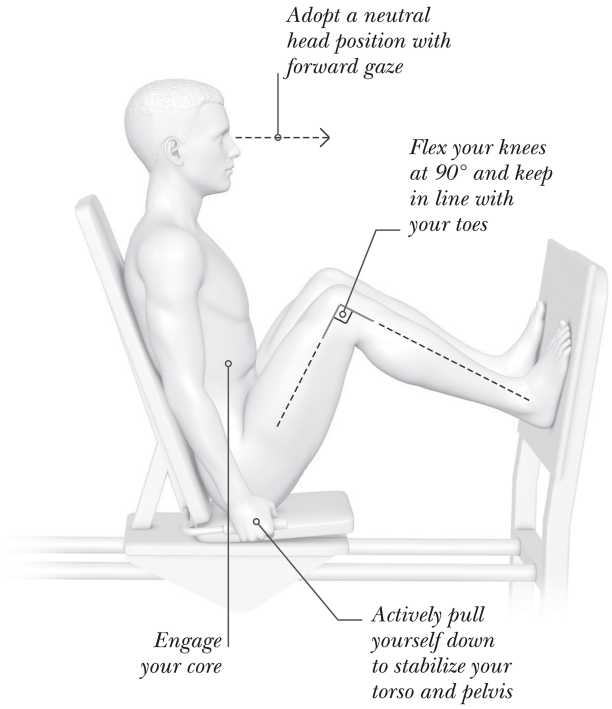
THE BIG PICTURE

The leg press offers a full leg workout. Set the weights, sit back on the pad, and adjust the foot platform position. For maximum effectiveness, you need to bend only at the hips and knees. Grip the handles on the machine to offer stability to your torso and pull yourself down into the seat.

Beginners can start with 4 sets of 8–10 reps; discover other targeted sets in the training programmes.

PREPARATORY STAGE

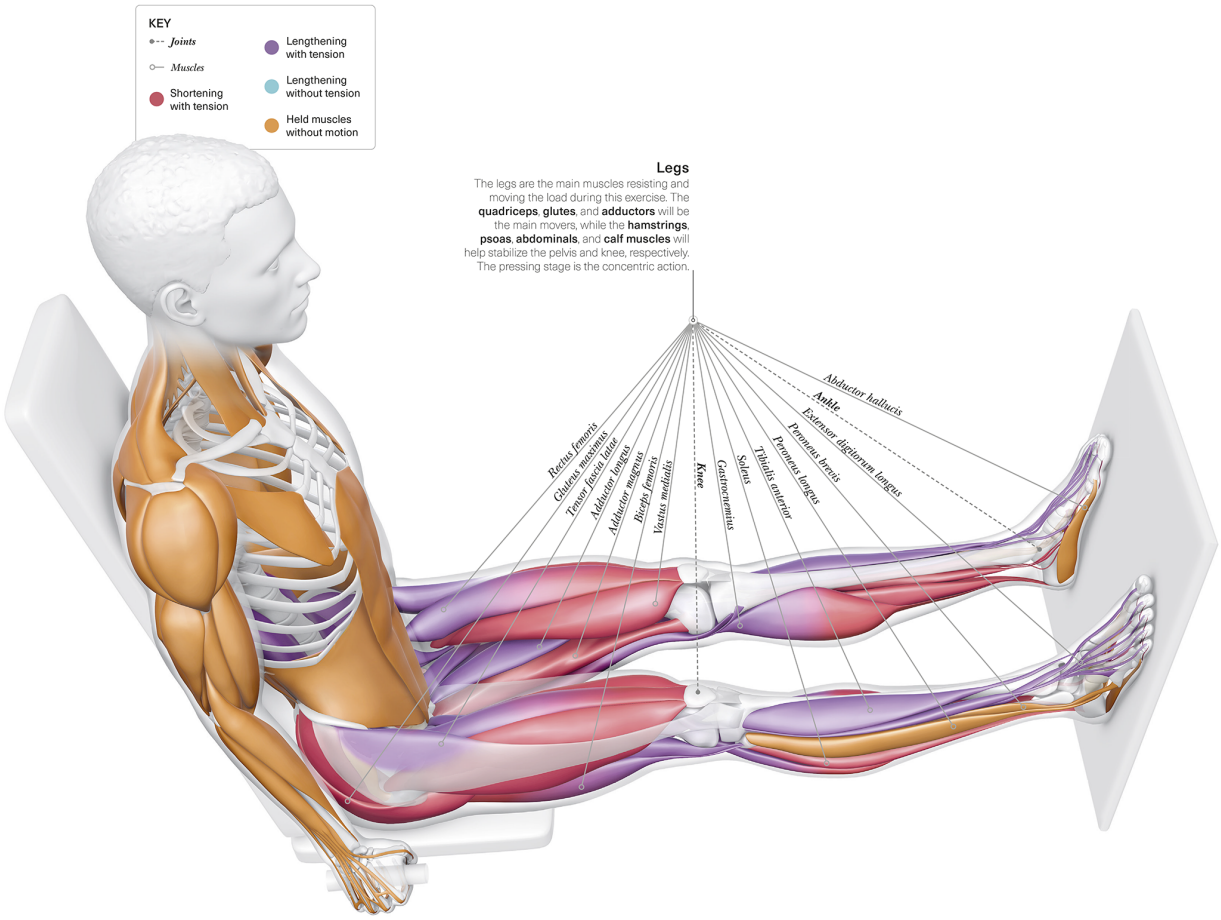
After setting up the machine, get into a stance similar to that of a back squat. Position your feet slightly outside shoulder-width and angle them a little outward. Engage your abdominals to keep your torso stable and your lower back flat on the back pad.



Double-tap image to read the labels

STAGE ONE

Keep abs engaged, with your lower back against the pad. Breathe out as you pull yourself down into the seat and push into the foot platform evenly across your feet. Extend at the hips and the knees, returning the foot platform to its starting position.



ℹ Double-tap image to read the labels

SUPERIOR-LATERAL VIEW

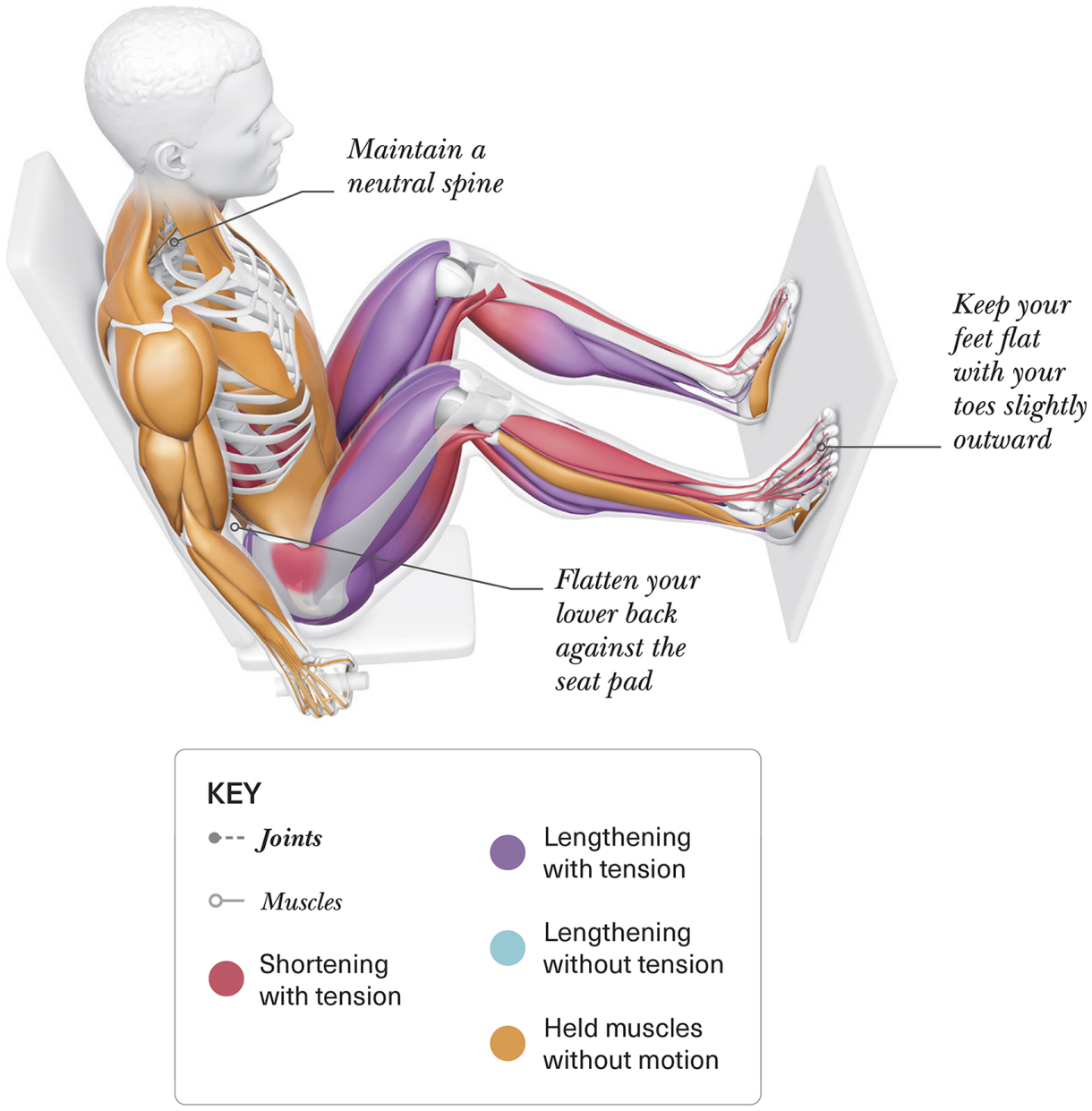
Legs

The legs are the main muscles resisting and moving the load during this exercise. The **quadriceps**, **glutes**, and **adductors** will be the main movers, while the **hamstrings**, **psoas**, **abdominals**, and **calf muscles** will help stabilize the pelvis and knee, respectively. The pressing stage is the concentric action.

STAGE TWO

Breathe in and allow your legs to bend at the knees and hips, so that your knees track forward in line with your feet (align between the first and second toes). Control the descent so that you decelerate as you

approach the starting position. Reset your breathing and repeat stages 1 and 2.



Double-tap image to read the labels

Common mistakes

Be careful not to bend your legs too far; if your bottom comes off the pad and your lower back starts to round, you are bending too far.

HACK SQUAT

This squat strengthens the quadriceps, adductors, and glutes, and also challenges the hamstrings. This machine-based exercise has a predefined movement pattern, so it works the big leg muscles while minimizing injury risk or working around pre-existing injuries.

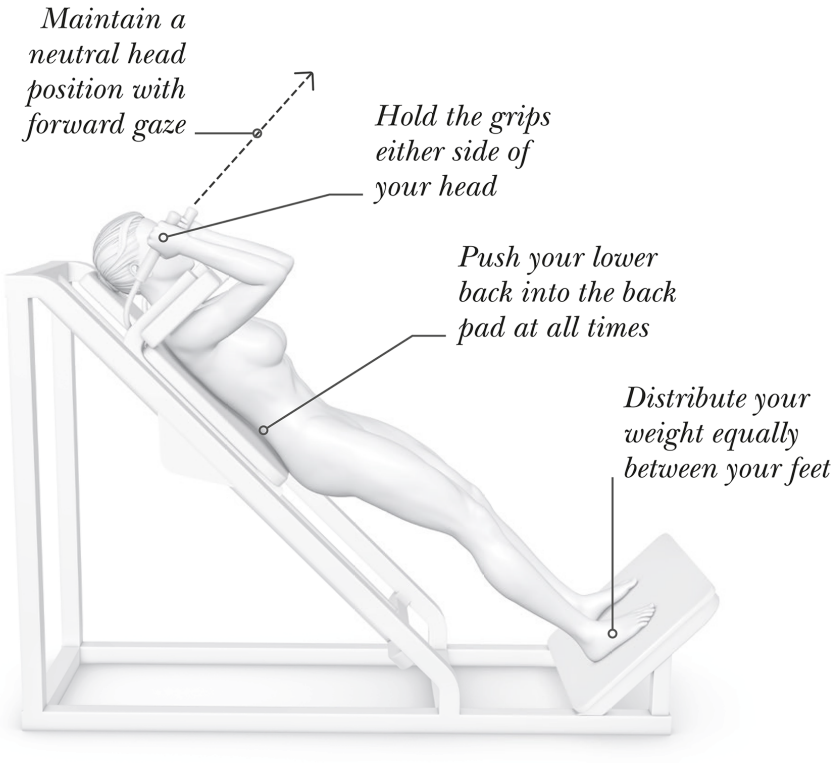
THE BIG PICTURE

This compound or multi-joint squatting move is often built into workouts to complement other lower-body strength movements. Keep your core engaged to avoid straining your lower back and be sure to train within your available (active) range of motion. Before you start, set the weights and check your movement up and down on the machine.

Beginners can start with 4 sets of 8–10 reps; discover other targeted sets in the training programmes.

PREPARATORY STAGE

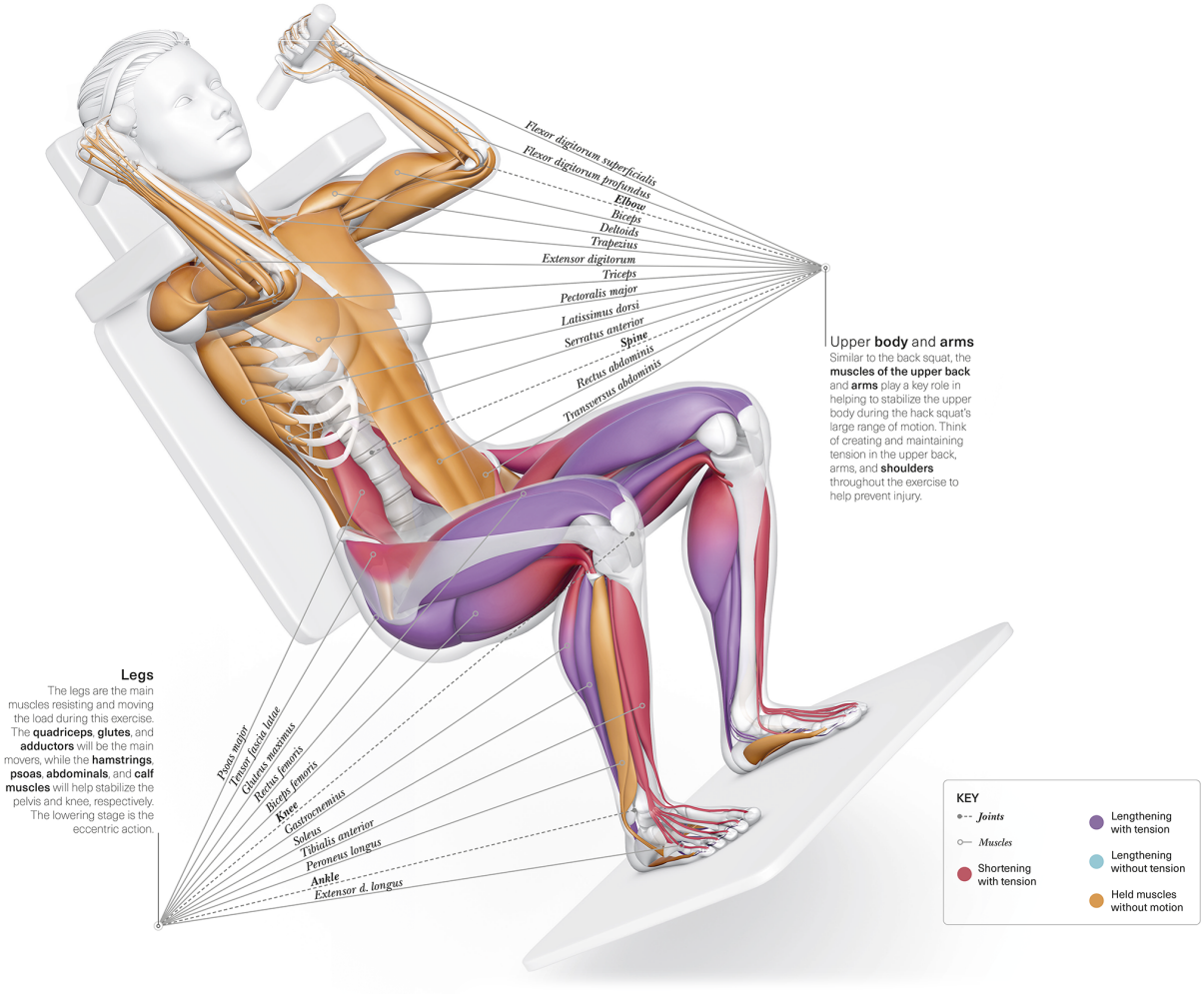
Position yourself onto the machine and get into the standing starting position. Your stance on the foot platform will closely mimic that in the back squat – your feet should be slightly outside shoulder-width with feet angled slightly outward.



Double-tap image to read the labels

STAGE ONE

Breathe in and allow your legs to bend at the knees and the hips. Your knees should track forward in line with your feet until they are roughly at 90°. Control the descent and start to decelerate as you near the bottom position.



ℹ Double-tap image to read the labels

ANTERIOR-LATERAL VIEW

Upper **body** and **arms**

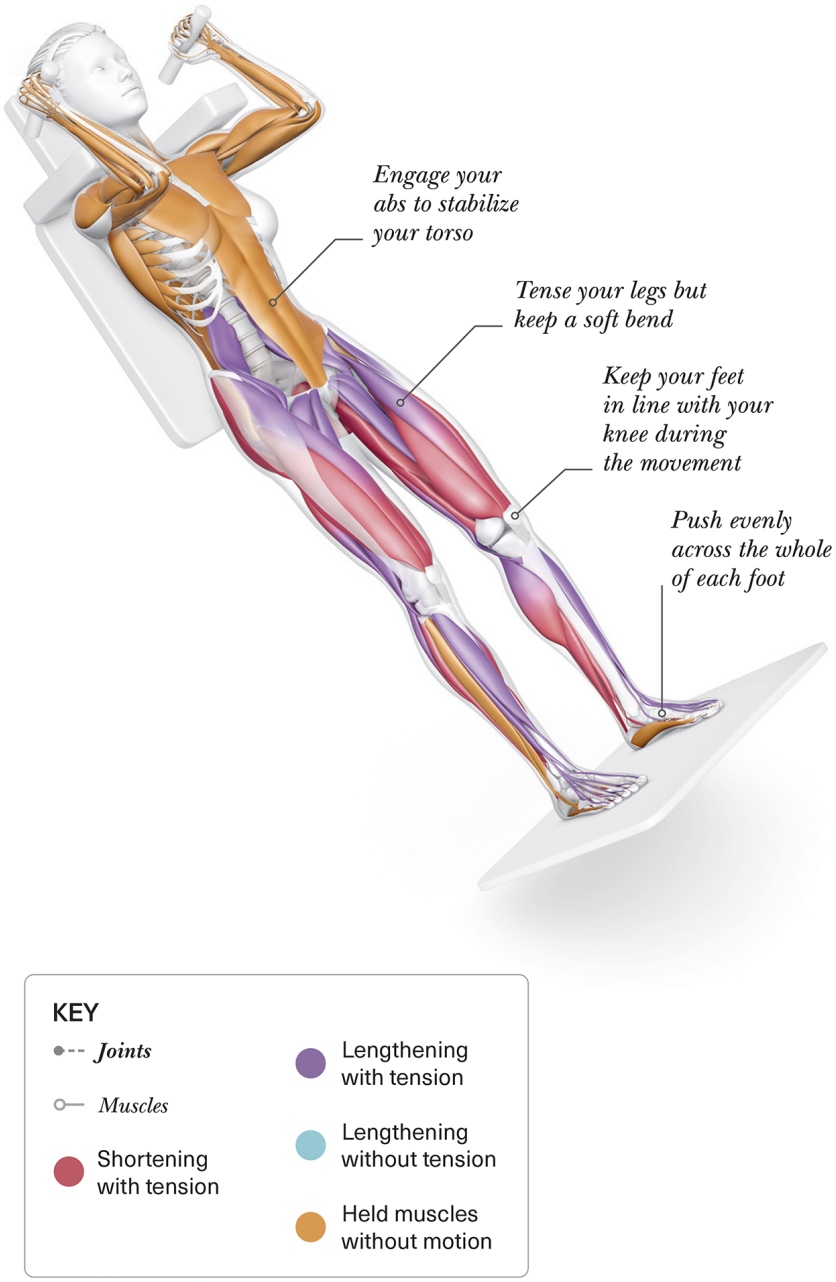
Similar to the back squat, the **muscles of the upper back** and **arms** play a key role in helping to stabilize the upper body during the hack squat's large range of motion. Think of creating and maintaining tension in the upper back, arms, and **shoulders** throughout the exercise to help prevent injury.

Legs

The legs are the main muscles resisting and moving the load during this exercise. The **quadriceps**, **glutes**, and **adductors** will be the main movers, while the **hamstrings**, **psoas**, **abdominals**, and **calf muscles** will help stabilize the pelvis and knee, respectively. The lowering stage is the eccentric action.

STAGE TWO

While keeping your lower back against the back pad and with abs engaged, breathe out and push through the foot platform, extending at the hips and the knees to return to the starting position. Reset your breathing and repeat stages 1 and 2.



Double-tap image to read the labels

Common mistakes

Watch your foot position: if your heels rise as you squat or if you experience heightened stress at the knees, move your feet up slightly on the platform.

STATIONARY LUNGE WITH DUMBBELLS

The lunge is a useful exercise for training the quadriceps and glutes, while also challenging the muscles that stabilize the core. Both legs work hard, but the main focus is on the muscles of the front leg.

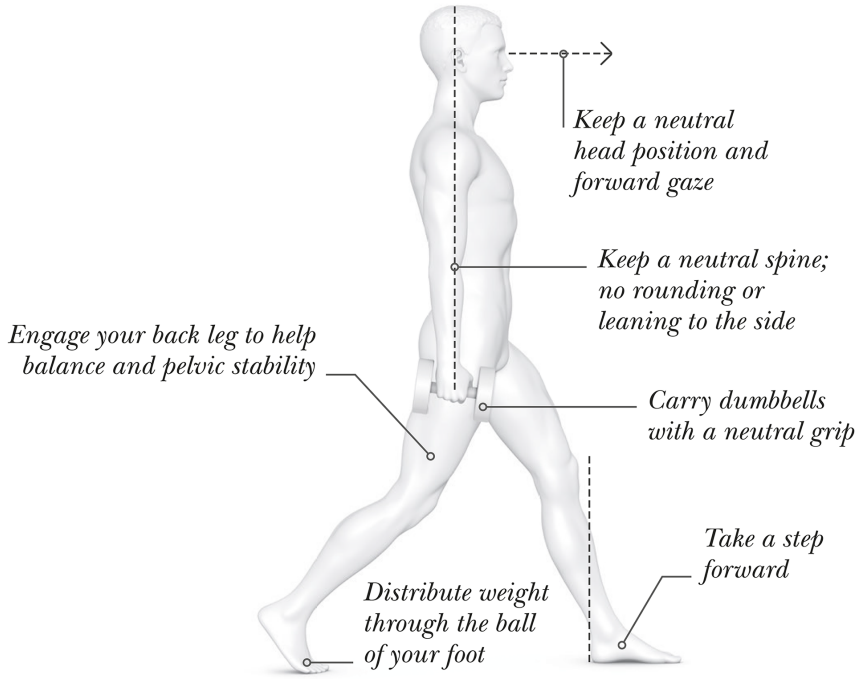
THE BIG PICTURE

As you lunge, think downward rather than forward. When in the lunge position, your ear, hip, elbow, and hand should be aligned vertically. Throughout the exercise, ensure your torso is stable, core engaged, and your weight is evenly distributed through your front foot and the ball of your back foot. Hold the weights at your side and carry them naturally into the lunge motion. To be sure to exercise both legs evenly, work alternate legs each rep or keep the leg consistent through a set.

Beginners can start with 4 sets of 8–10 reps; discover variations on this exercise and other targeted sets within the training programmes.

PREPARATORY STAGE

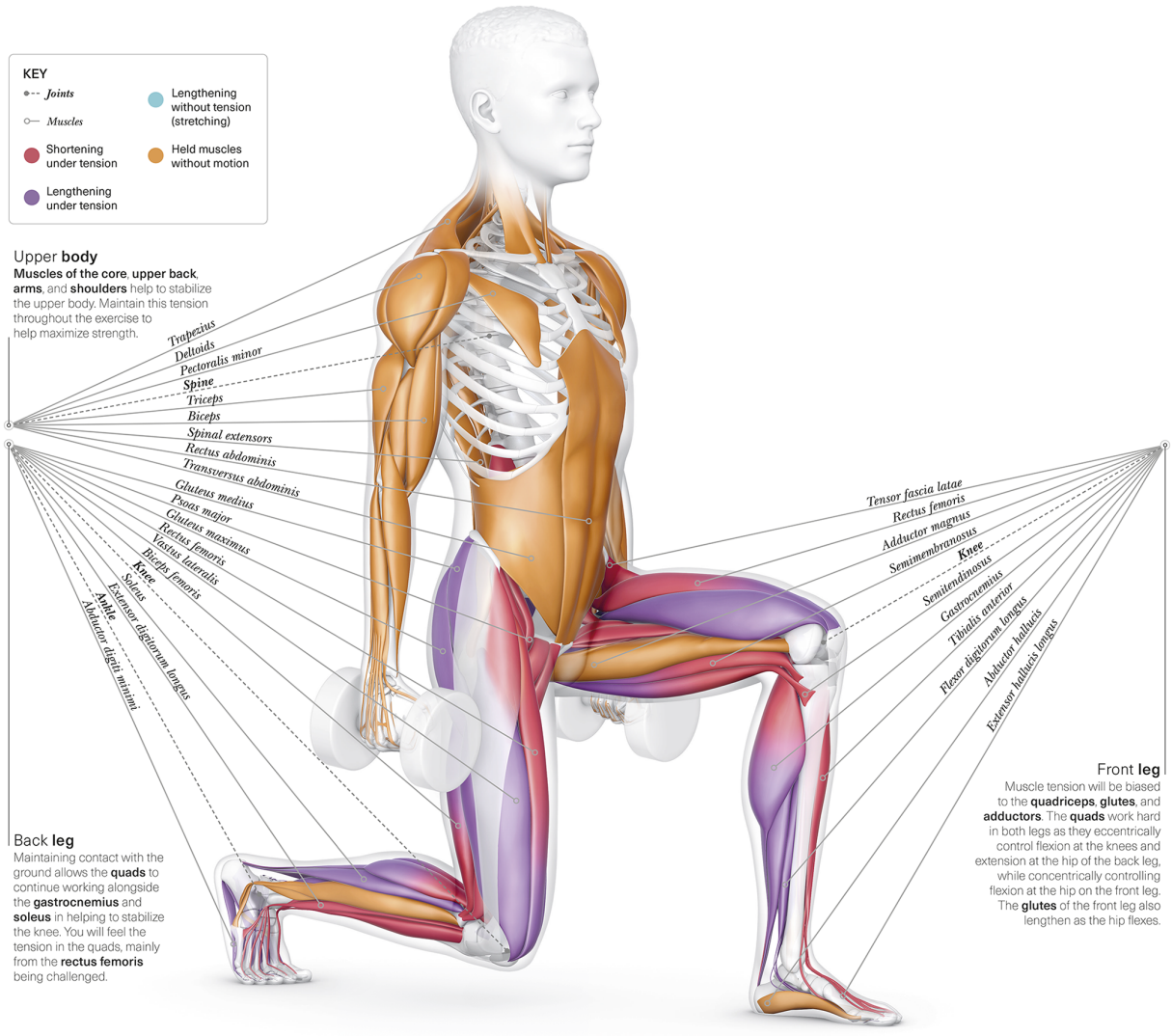
Stand with your feet shoulder-width apart, holding the weights at your side. Take a step forward with one leg with your normal stride. This is the starting position.



Double-tap image to read the labels

STAGE ONE

Breathe in, engage your core, and drive your hip down as you drive your front knee forward and bend your back knee toward the floor. Control this lowering phase of your front leg to protect your knees as you approach the end position. Hold the lunge for 1 second.



ℹ Double-tap image to read the labels

ANTERIOR-LATERAL VIEW

Upper **body**

Muscles of the core, **upper back**, **arms**, and **shoulders** help to stabilize the upper body. Maintain this tension throughout the exercise to help maximize strength.

Back **leg**

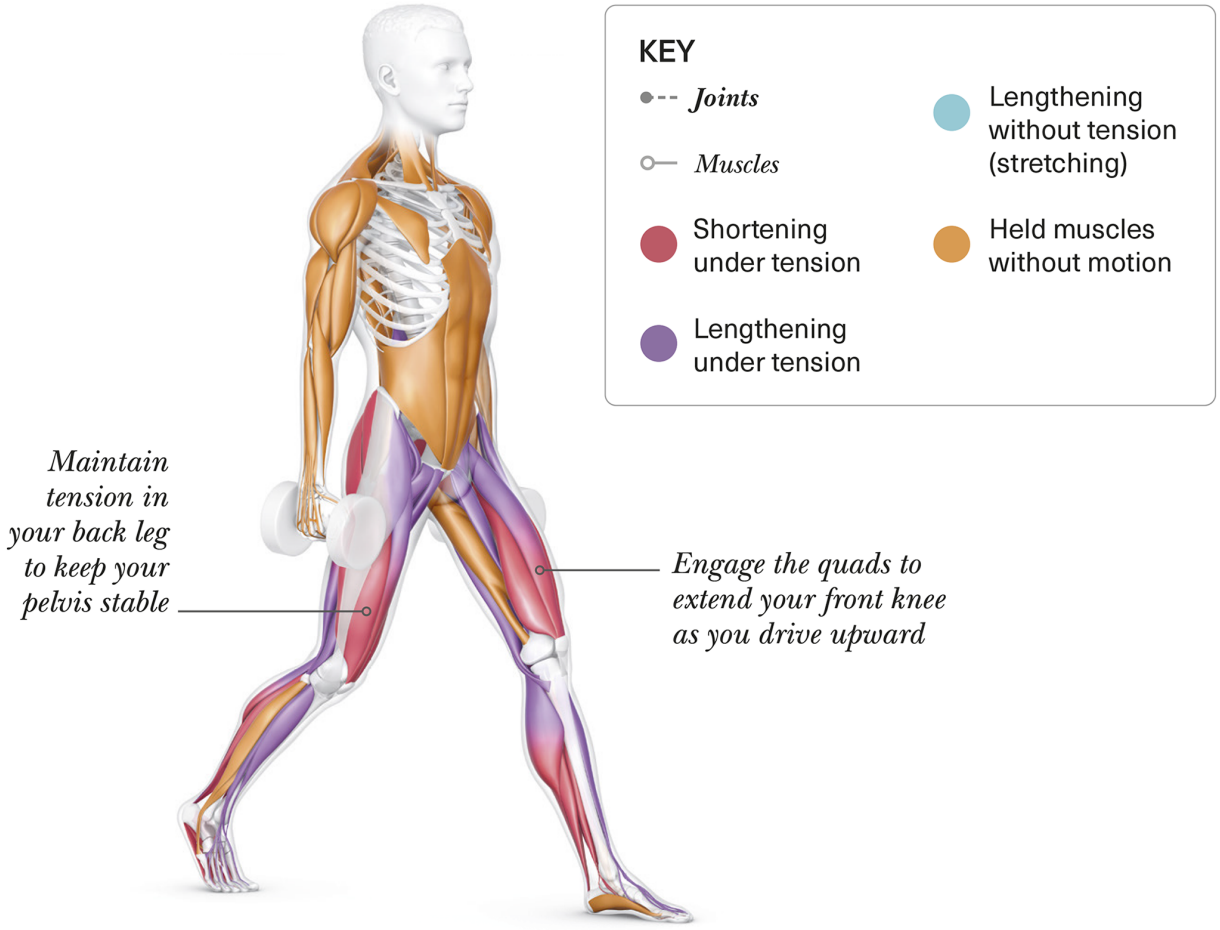
Maintaining contact with the ground allows the **quads** to continue working alongside the **gastrocnemius** and **soleus** in helping to stabilize the knee. You will feel the tension in the quads, mainly from the **rectus femoris** being challenged.

Front **leg**

Muscle tension will be biased to the **quadriceps**, **glutes**, and **adductors**. The **quads** work hard in both legs as they eccentrically control flexion at the knees and extension at the hip of the back leg, while concentrically controlling flexion at the hip on the front leg. The **glutes** of the front leg also lengthen as the hip flexes.

STAGE TWO

Breathe out, engaging the glutes and quads, and push through the ball of your foot to raise your body back to the starting position. Ensure you are balanced and stable before the next rep. Repeat stages 1 and 2.



Double-tap image to read the labels

Common mistakes

Taking too big or too small a step forward results in poor form for your lunge. And don't round your upper back.

VARIATIONS

To improve your form through a lunging movement, you may want to practise first without any weights; all lunges target the quads, hamstrings, and glutes. Dumbbells should always be held by your side and carried naturally in and out of the movement.

FRONT FOOT ELEVATED SPLIT SQUAT WITH DUMBBELLS

This variation raises the front foot on a step or sturdy box to increase the range of motion while reducing the load on the front knee; keep your legs active to help pelvic stability. Try this easier version if you're new to lunging movements.

PREPARATORY STAGE

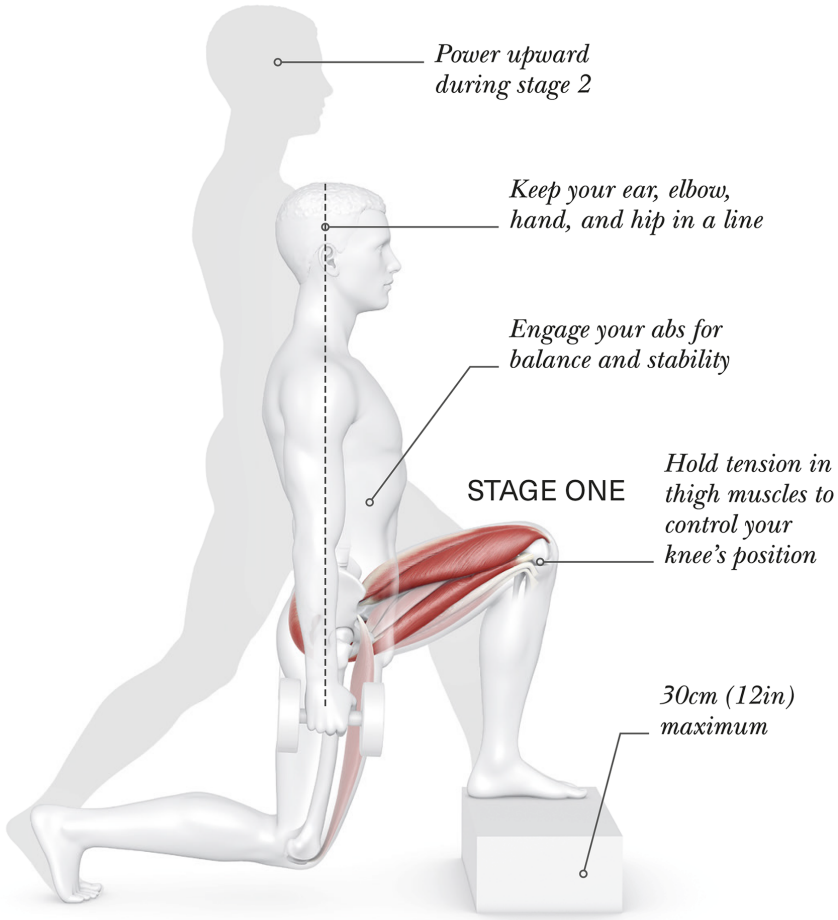
Stand with feet shoulder-width apart in a staggered stance. Step your leading leg onto the box. Keep your knees soft and engage your back leg for balance.

STAGE ONE

Breathe in as you drive your hip down and push your front knee forward while your back knee drops toward the floor. Keep your abs activated.

STAGE TWO

Breathe out and power upward using your quads and glutes. Repeat stages 1 and 2 for the desired number of reps, then repeat for the other leg.



Double-tap image to read the labels

BACK FOOT ELEVATED SPLIT SQUAT WITH DUMBBELLS

In this variation, the step or sturdy box increases the amount of hip flexion possible and adds challenge to your quads; but if the step is too high, your hips may shift out of alignment. Keep your torso still and your arms at your sides.

PREPARATORY STAGE

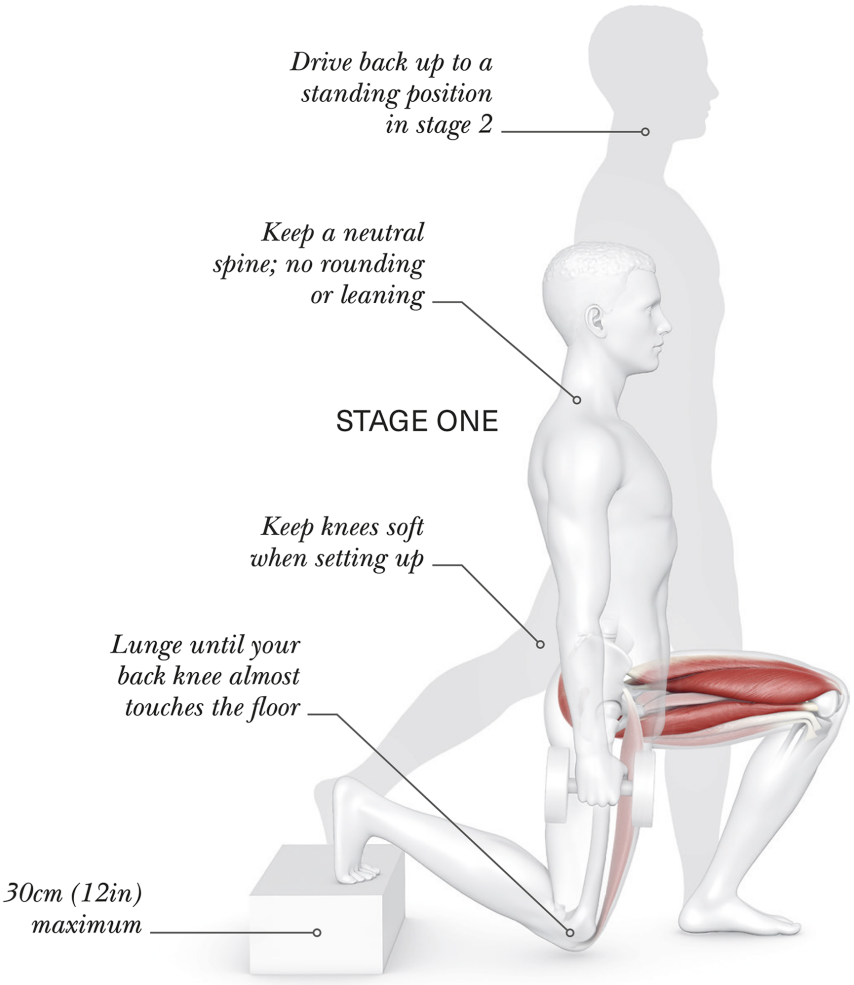
Stand with your feet shoulder-width apart in front of the box. Step backward with one leg to rest on the ball of your foot. Engage your back leg for stability.

STAGE ONE

Breathe in and press downward with your back knee while your front leg flexes at the knee. Keep the abs engaged and a neutral spine throughout.

STAGE TWO

Exhale to drive back upward using your quads and glutes. Repeat stages 1 and 2 for the desired number of reps, then repeat for the other leg.



Double-tap image to read the labels

WALKING LUNGE WITH DUMBBELLS

This variations aims to add challenge and coordination to the stationary lunge. When starting this exercise, use little or no load to ensure you can remain balanced and coordinated as you get used to this walking variation of the lunge. Once you're confident in the movement, then add in more weight.

PREPARATORY STAGE

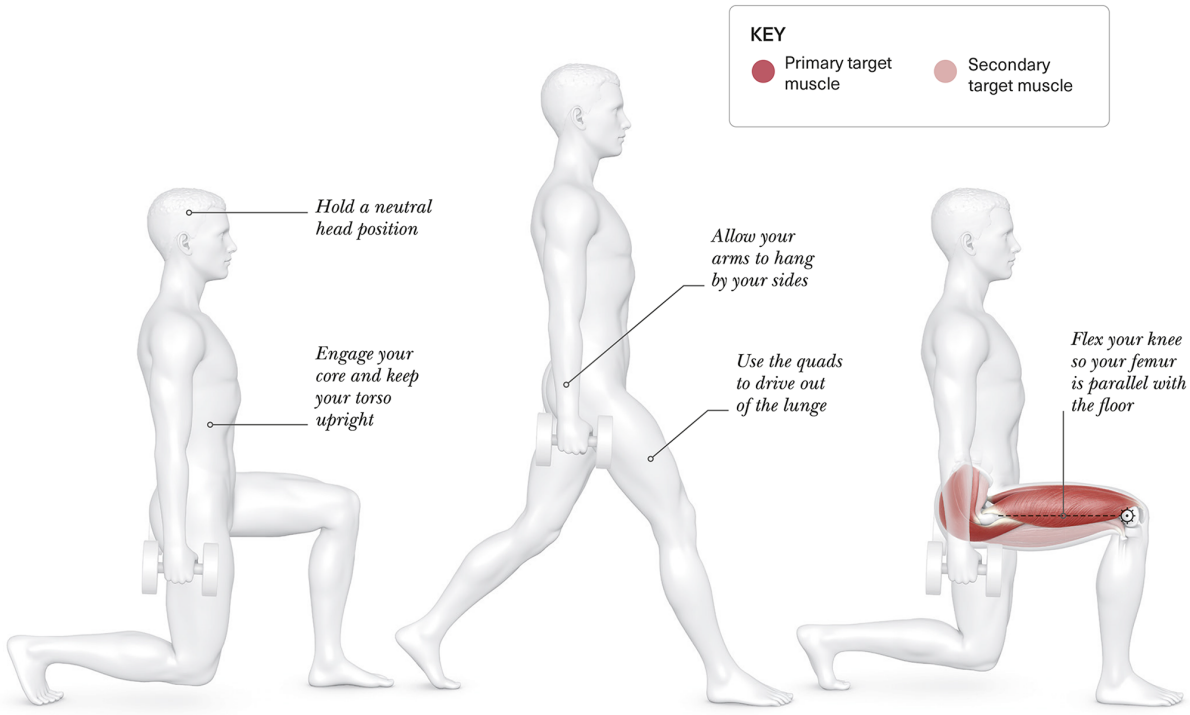
Place your feet shoulder-width apart. Breathe in and stride forward into the lunge position – your front knee is flexed at 90°; your back knee is just off the floor.

STAGE ONE

Power up and out of the lunge, breathing out, and take a stride forward with your other leg. Stand tall and keep your abs engaged throughout.

STAGE TWO

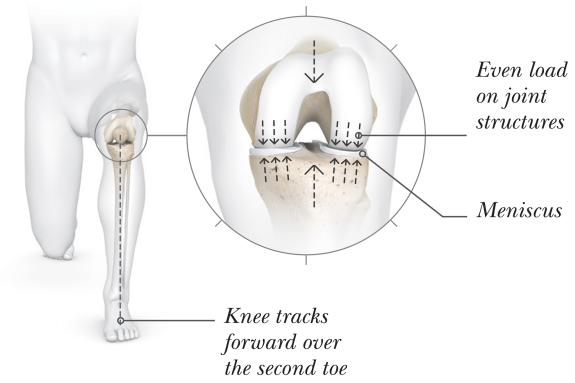
Breathe in as you drive your hip down and your front knee forward, allowing your back knee to flex, as before. Repeat, alternating legs as you move along.



Double-tap image to read the labels

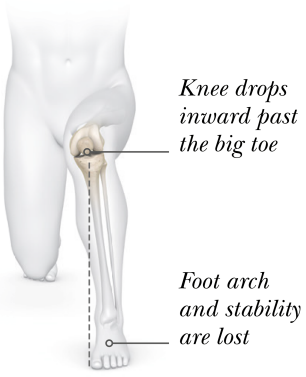
Knee **alignment**

A common misalignment happens when the knee tracks inward past the big toe, which can cause problems for the knee and lead to pain and injury. Keep your knee tracking forward in alignment with your second toe – this helps maintain stability around your knee and reduce the risk of injuring yourself.



Double-tap image to read the labels

ALIGNMENT



Double-tap image to read the labels

MISALIGNMENT

STEP UP WITH DUMBBELLS

This exercise strengthens the quadriceps and glutes while simultaneously challenging the muscles that stabilize the core.

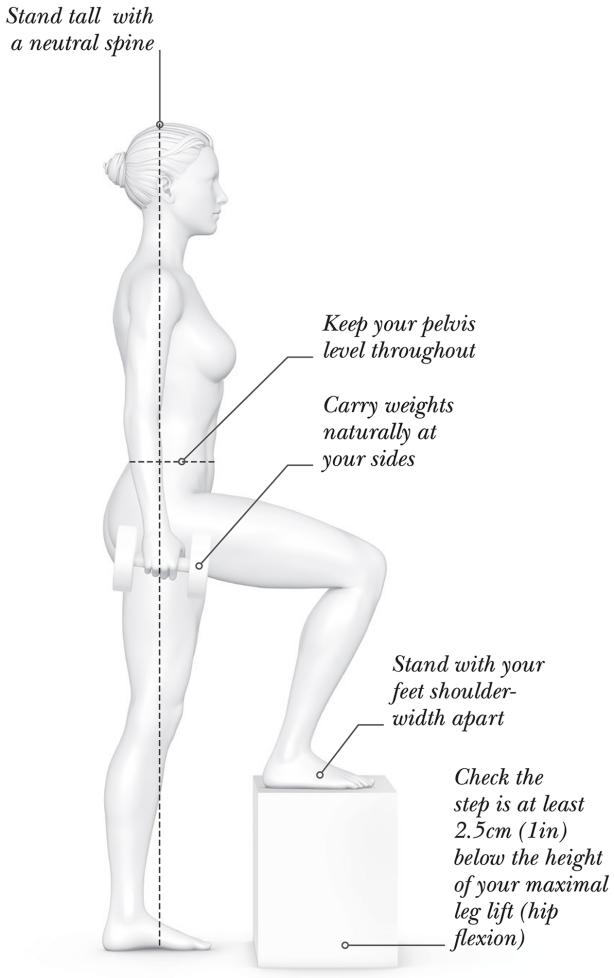
THE BIG PICTURE

You will need an exercise step at least 30cm (12in) high. The main focus will be on the front leg, which remains on the step, while you engage your core throughout. Ensure your foot is wholly on the step and your feet are shoulder-width apart. You'll drive through the front leg to step up; do not push off with your back foot. To be sure to exercise both legs, work alternate legs each rep or keep the leg consistent through a set.

Beginners can start with 4 sets of 8–10 reps; discover other targeted sets in the training programmes.

PREPARATORY STAGE

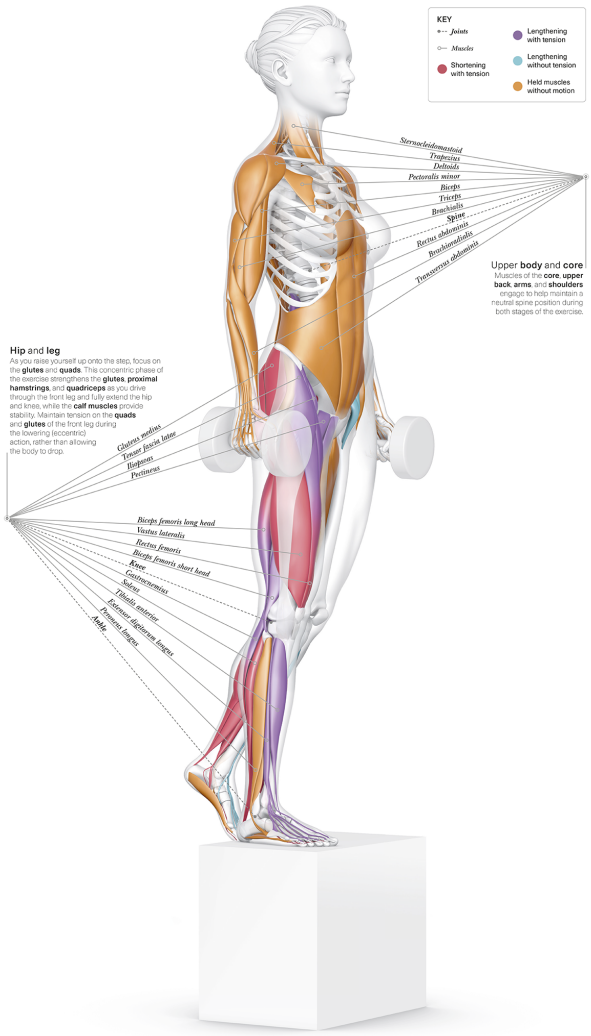
Stand tall with the step in front of you and weights in your hands at your sides. Raise your front leg to place it on the step. Keep your back leg engaged to help maintain balance and pelvic stability.



Double-tap image to read the labels

STAGE ONE

Breathe in, engage your core, and drive through your front foot to extend your front leg, bringing you to the top position. Keep your back leg extended – it will lift off the ground as you transfer your weight to your front leg. Hold the position for 1 second to ensure you remain balanced and are prepared for descent.



Double-tap image to read the labels

ANTERIOR-LATERAL VIEW

Upper **body** and **core**

Muscles of the **core**, **upper back**, **arms**, and **shoulders** engage to help maintain a neutral spine position during both stages of the exercise.

Hip and leg

As you raise yourself up onto the step, focus on the **glutes** and **quads**. This concentric phase of the exercise strengthens the **glutes**, **proximal hamstrings**, and **quadriceps** as you drive through the front leg and fully extend the hip and knee, while the **calf muscles** provide stability. Maintain tension on the **quads** and **glutes** of the front leg during the lowering (eccentric) action, rather than allowing the body to drop.

STAGE TWO

Breathe out and begin to lower your body by flexing your front hip and knee, and by reaching down with your back leg till it touches the ground. Reset your breathing, focus, and core stability. Repeat stages 1 and 2.



ⓘ Double-tap image to read the labels

Common mistakes

Springing from the leg on the ground rather than using the leg on the step means you won't be placing as much tension on the target muscles; it may also indicate you're trying to lift too much weight.

LEG CURL

This exercise trains the hamstrings of the thigh and the main calf muscle – the gastrocnemius – both of which help flex the knee. From this fixed, prone position, you can flex at the knee with great force without loading the spine.

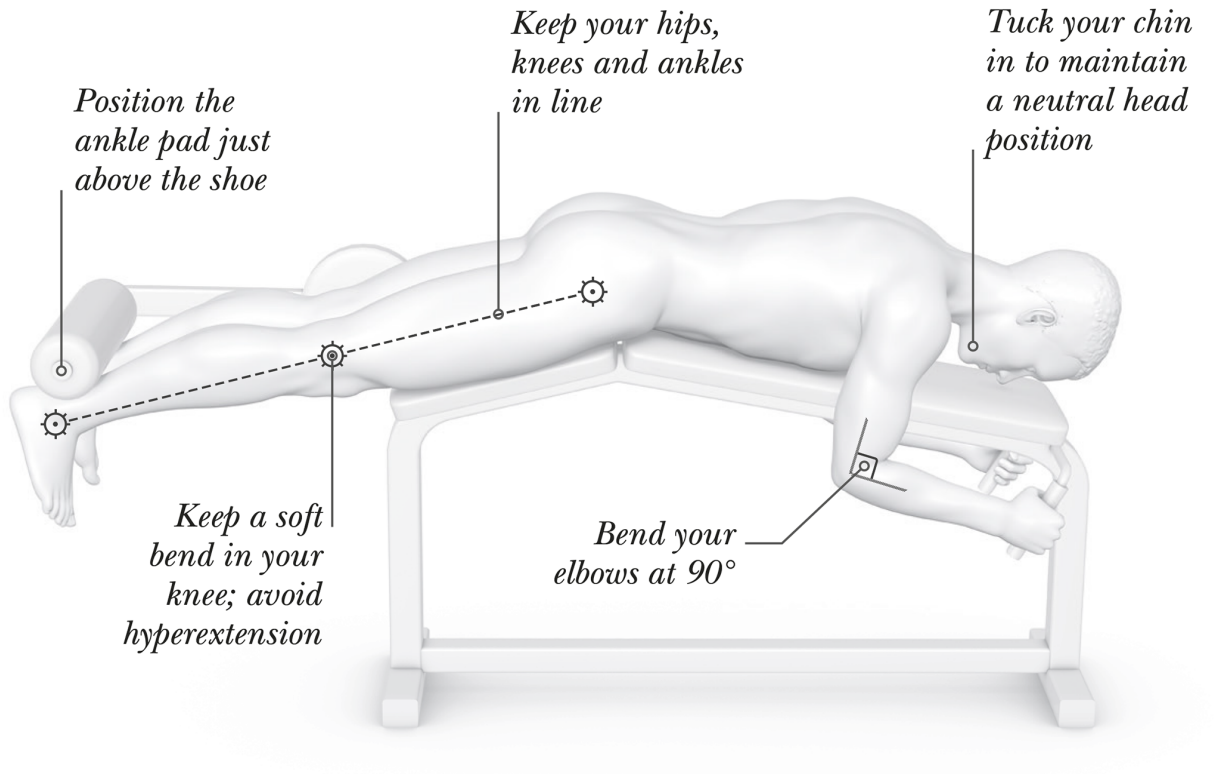
THE BIG PICTURE

This lying-down movement focusses effort on the knee joint as you curl your leg from straight to bent. It's important to engage your abdominals to stabilize your torso and to avoid any back strain. Before you start, set the weights and check the ankle pad.

Beginners can start with 4 sets of 8–10 reps; discover other variations of this exercise and other targeted sets in the training programmes.

PREPARATORY STAGE

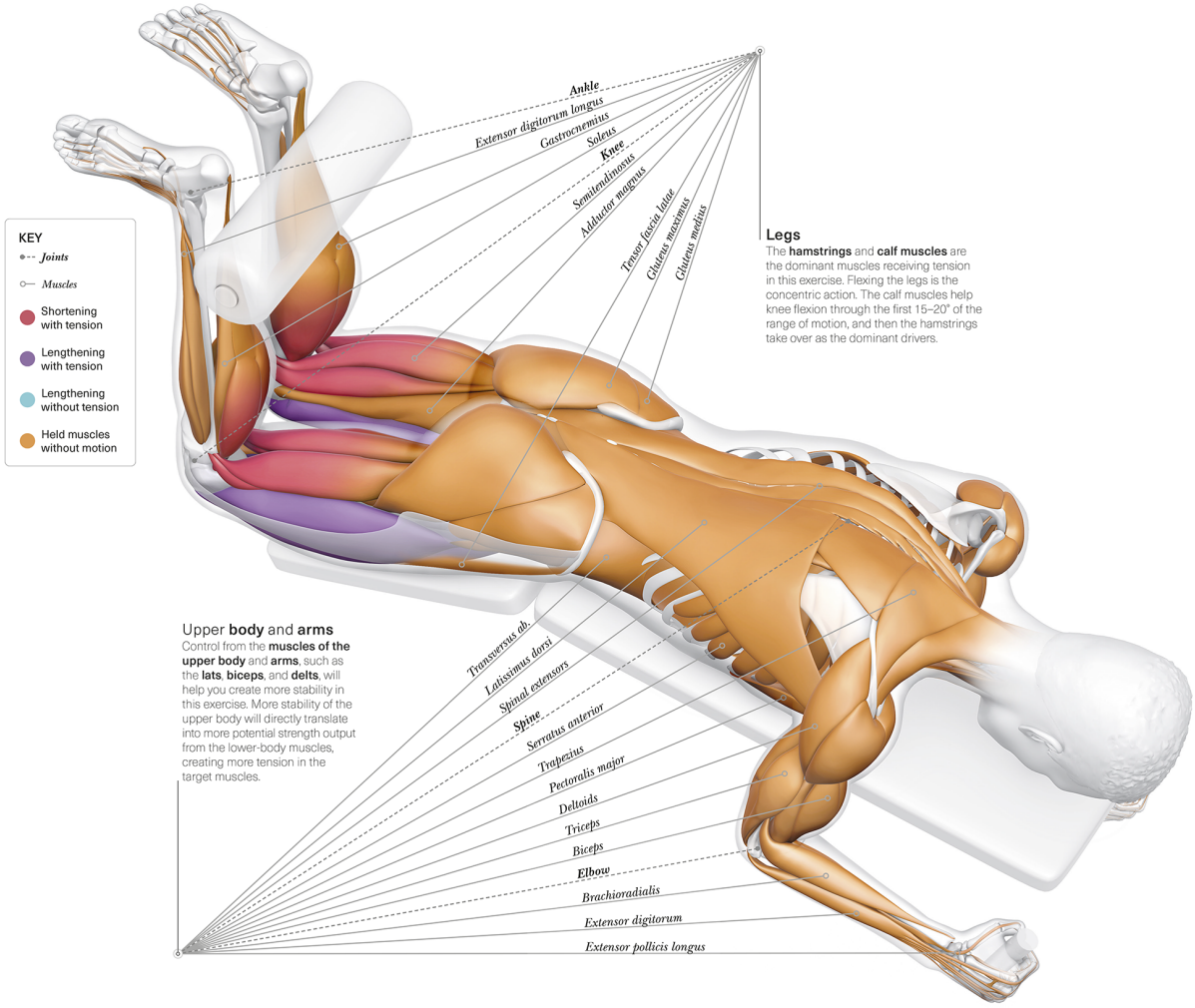
Lie prone on the machine with your legs extended and the ankle pad just above your shoes. From there, engage your abs and latissimus dorsi by pulling against the handles of the machine, and squeeze your glutes to help stabilize your pelvis.



Double-tap image to read the labels

STAGE ONE

Breathe in and slowly flex at the knee with control, then accelerate into the rep until you reach the end range of your knee flexion (everyone's is slightly different). Ensure your ankles are dorsiflexed – point your toes upward with tension through the muscles of your shin.



ℹ Double-tap image to read the labels

SUPERIOR-ANTERIOR-LATERAL VIEW

Legs

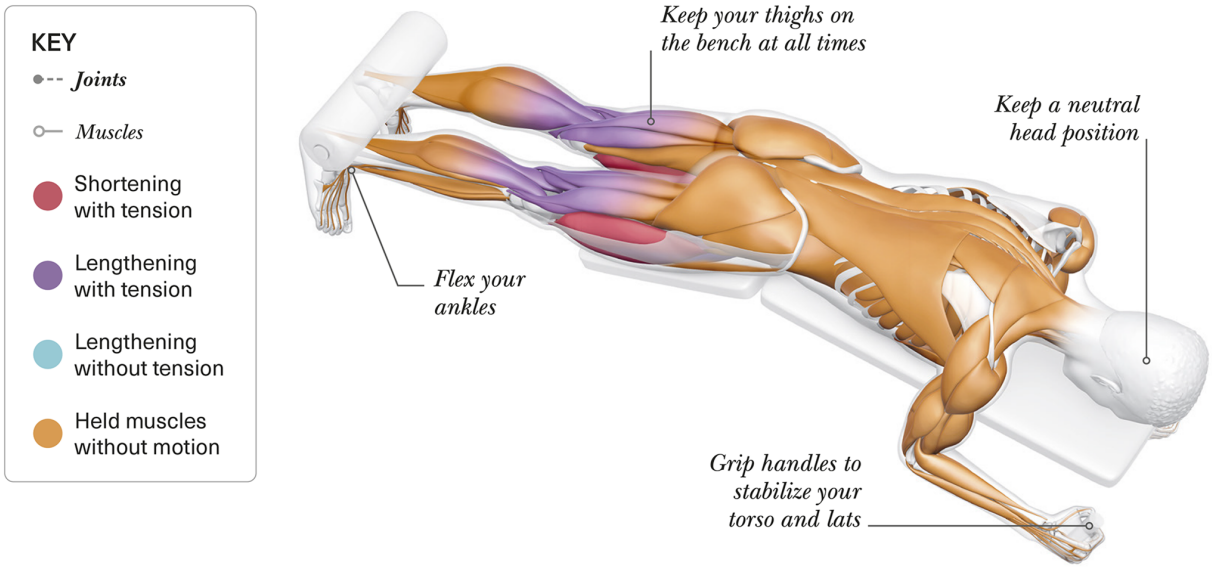
The **hamstrings** and **calf muscles** are the dominant muscles receiving tension in this exercise. Flexing the legs is the concentric action. The calf muscles help knee flexion through the first 15–20° of the range of motion, and then the hamstrings take over as the dominant drivers.

Upper **body** and **arms**

Control from the **muscles of the upper body** and **arms**, such as the **lats**, **biceps**, and **delts**, will help you create more stability in this exercise. More stability of the upper body will directly translate into more potential strength output from the lower-body muscles, creating more tension in the target muscles.

STAGE TWO

With abs engaged, breathe out as you drive your feet back toward the wall behind you – think about lengthening the hamstrings as you return to the starting position. Reset your breathing and repeat stages 1 and 2.



Double-tap image to read the labels

Common mistakes

Do not launch the weight from the bottom position. Think of starting the rep slower and then accelerate through the load to the top of the rep.

VARIATIONS

Like the leg curl on the previous pages, all of these variations target the hamstrings and the gastrocnemius. Being able to perform such exercises standing up or sitting down opens up possibilities for an at-home variation or utilizing different machines at the gym.

SEATED UNILATERAL BANDED LEG CURL

Choose an appropriate resistance band and find a stable anchor point to fix it to; the anchor point should be at about eye level. This exercise focusses on one leg at a time so be sure to alternate your legs.

PREPARATORY STAGE

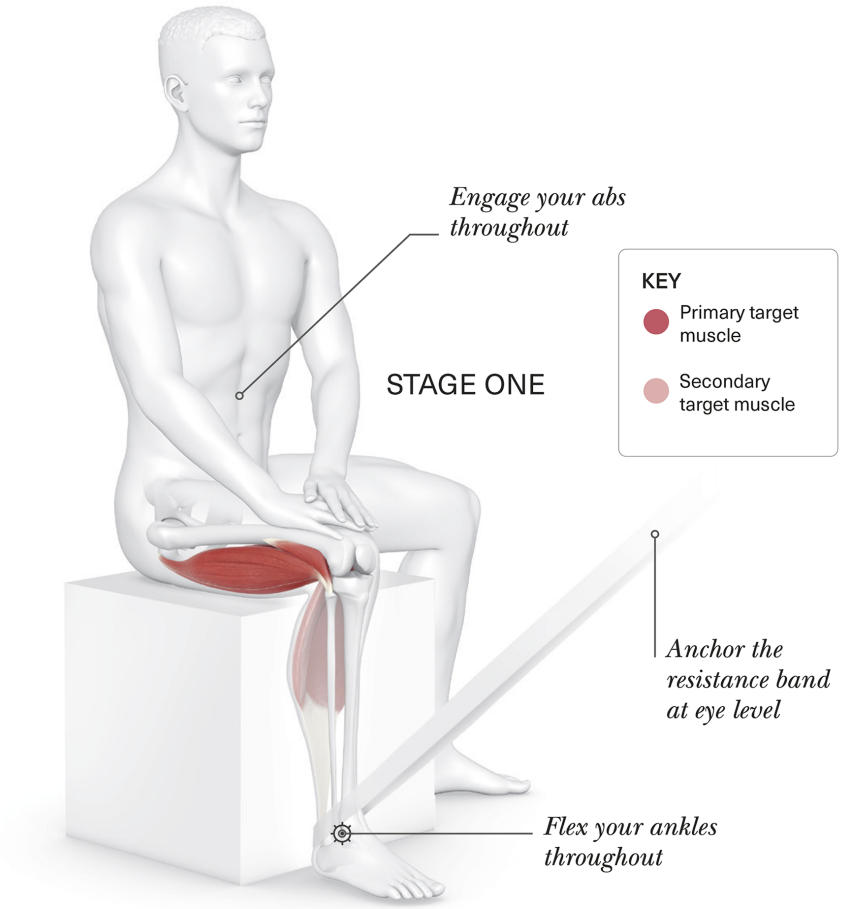
Fix the resistance band. Sit tall with a wide stance and your feet flat on the floor. Position the band just above the back of your shoe on an outstretched leg.

STAGE ONE

Inhale, then breathe out as you curl your lower leg back toward your seat, keeping your foot off the floor. Feel the resistance of the band increase.

STAGE TWO

Keeping your abs engaged and ankle dorsiflexed, breathe in as you extend your leg to the starting position, with control. Repeat stages 1 and 2.



ⓘ Double-tap image to read the labels

SEATED LEG CURL

This seated machine-based variation increases the stabilization of the pelvis while still challenging knee flexion and the hamstrings in their lengthened position. You can use this exercise to effectively train the hamstrings and gastrocnemius via a different gym machine.

PREPARATORY STAGE

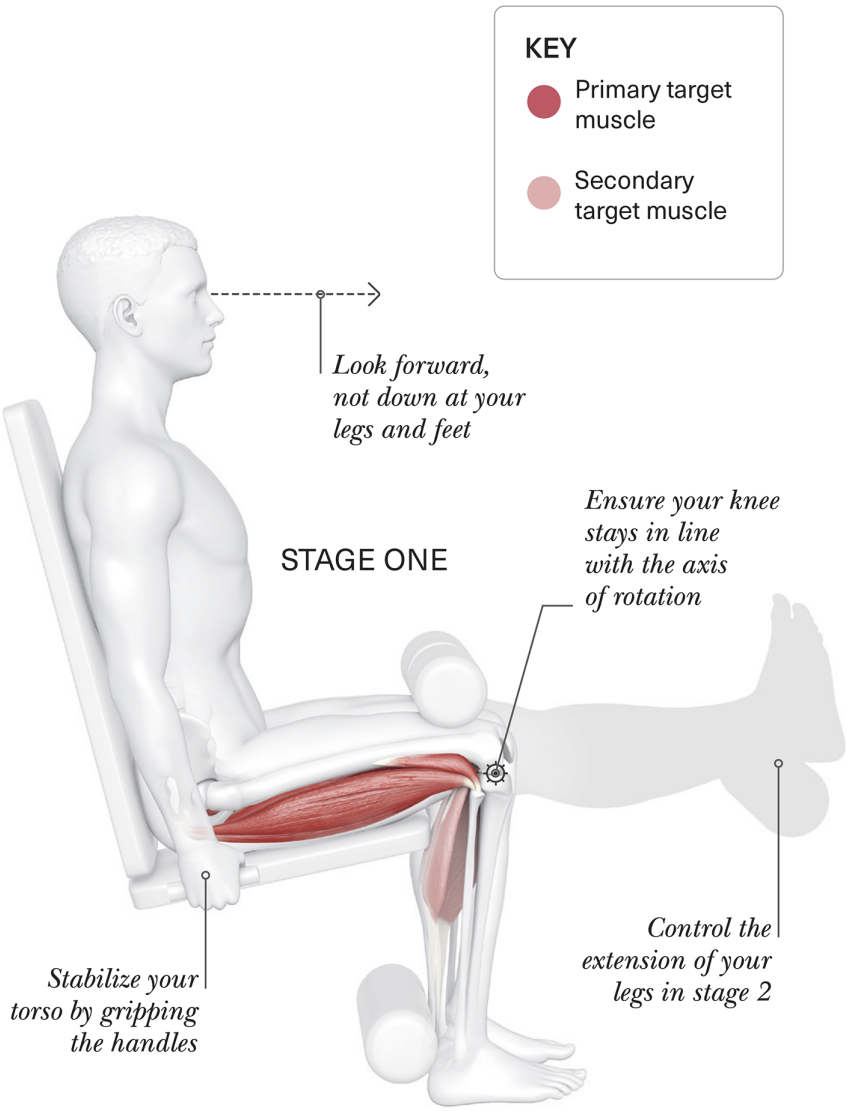
Set up the machine. Sit back against the pad with your knees bent around the end of the seat. Place your ankles on top of the lower pad and grip the handles.

STAGE ONE

Slowly flex at the knee with control while breathing out. Continue to flex until you reach the end of your knee flexion; be sure to dorsiflex your ankles.

STAGE TWO

Breathe in as you extend your legs in a controlled manner; imagine lengthening your hamstrings as you do so. Repeat stages 1 and 2.



Double-tap image to read the labels

STANDING UNILATERAL LEG CURL

You perform this gym-machine-based variation standing up. Since this movement trains one leg at a time, it's key to keep track of reps so that you can work each leg equally. Actively pulling on the handles stabilizes the latissimus dorsi (in the back), which offers further stability to the pelvis.

PREPARATORY STAGE

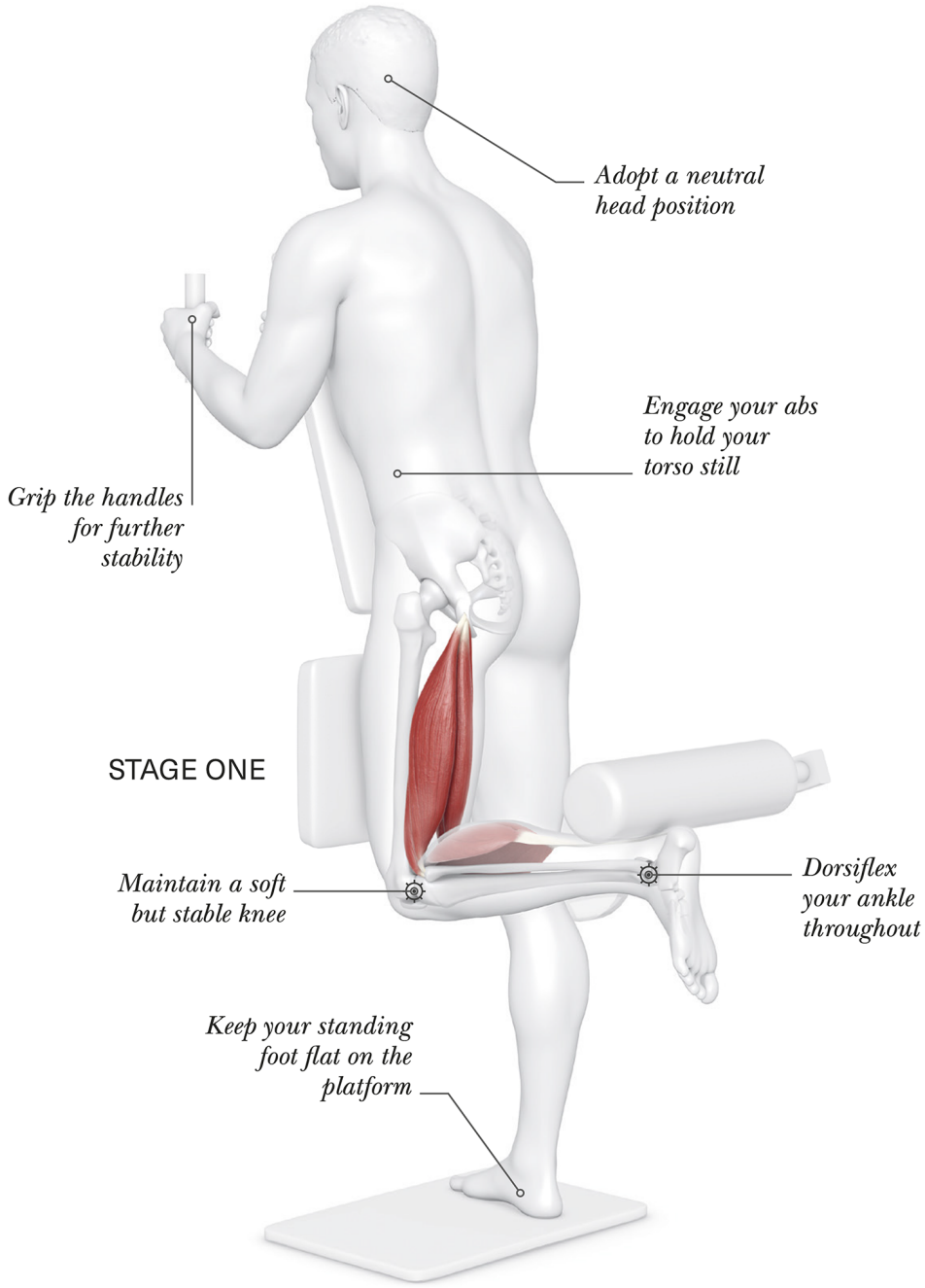
Set up the machine. Stand with your thighs pressed tight to the pad with one leg pushed against the lower leg pad. Maintain a forward gaze.

STAGE ONE

Inhale, engage your abs, and breathe out while flexing your knee fully in its range of motion. Tense the muscles of your shin to dorsiflex your ankle.

STAGE TWO

Breathe in to return to the starting position by extending your working leg completely, resisting the weight as you go. Repeat stages 1 and 2.

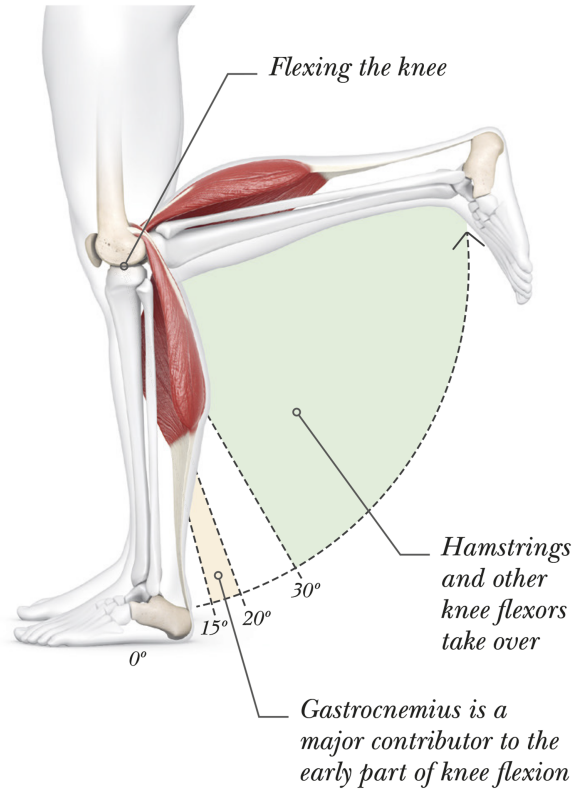


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“Knee flexion variations are great for ***challenging the hamstrings and other knee flexors*** *in a safe and controlled environment.”*

Role of the **gastrocnemius** in **knee flexion**

The integration of the gastrocnemius and other knee flexors (such as hamstrings) allows the knee to have good stability throughout the range of motion where the hamstrings lack leverage (between 0 and 15°). To avoid the common mistake of generating a lot of momentum at the start of a knee-flexion exercise, it's better to integrate both calf and hamstrings in a controlled way, so that flexing your knee puts tension in all the right muscles.



Double-tap image to read the labels

LATERAL VIEW

HAMSTRING BALL CURL

This exercise targets the hamstrings and the gastrocnemius and allows you to train the hamstrings without loading the spine or needing machines. Much work is also done by your core and glutes to support your raised torso during this rolling movement.

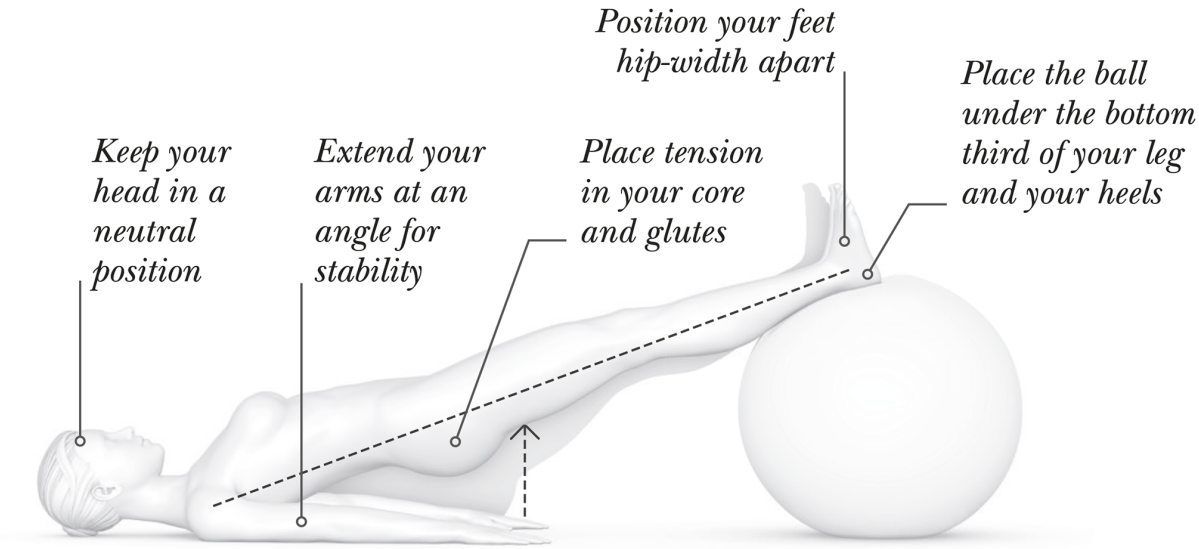
THE BIG PICTURE

You will need an exercise ball with a diameter of at least 55–65cm (21½–26in). Your back should be flat on the floor and your hips extended, with the contact points of the ball on the lower part of your legs and heels. Then, you'll raise your body into a bridge position. One of the greatest challenges of this movement is being able to flex at the knee using your hamstrings while all the time holding the same body position, with your hips off the floor and your torso stable.

Beginners can start with 4 sets of 8–10 reps; discover other targeted sets in the training programmes. If your hips start to drop, lower the reps for each set and increase the number of total sets. To push your core muscles further, fold your arms across your chest.

PREPARATORY STAGE

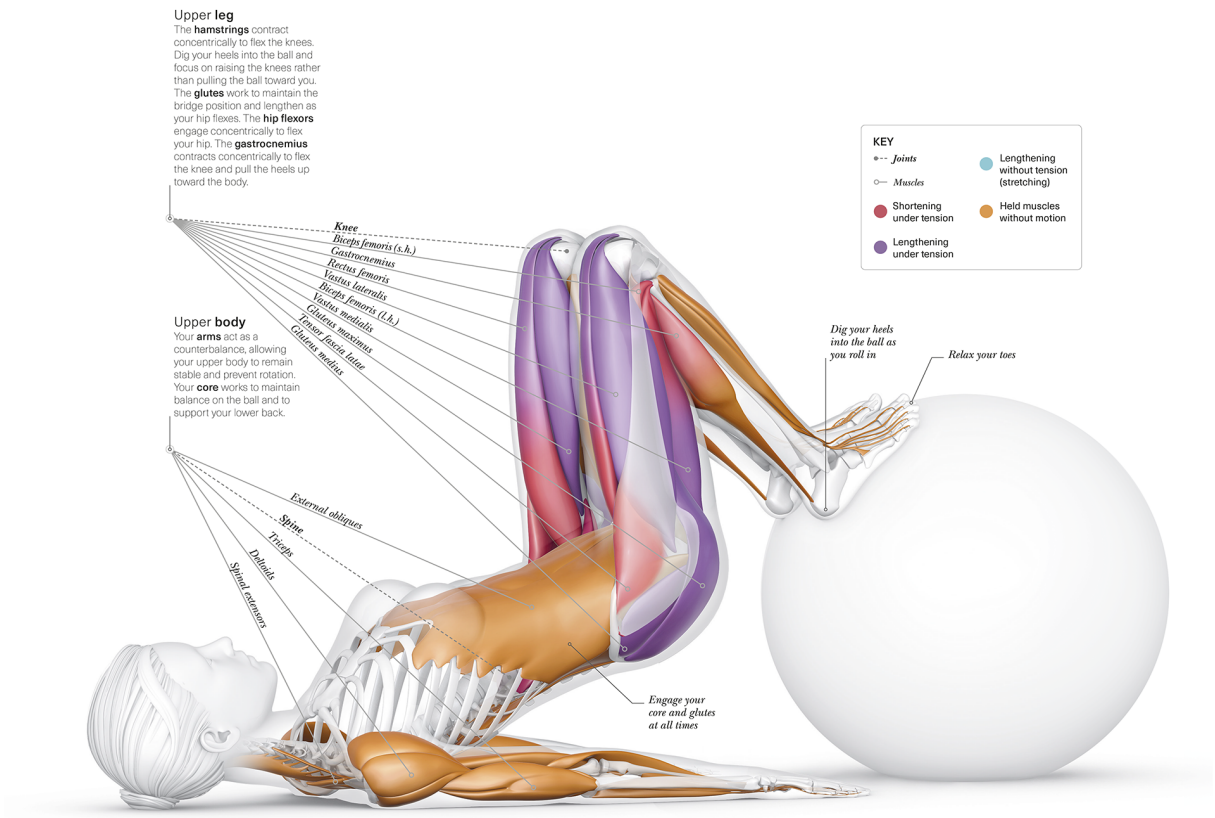
Lie on the floor on your back with arms out to the sides and palms facing downward. Position your legs and heels on the ball, and place tension in your core and glutes to raise your body into a bridge position. Keep a neutral head and spinal position.



Double-tap image to read the labels

STAGE ONE

Breathe in to engage your core. Then breathe out and engage the hamstrings to flex your knees and roll the ball toward you while keeping your hips raised off the floor. Hold for 1–2 seconds.



Double-tap image to read the labels

ANTERIOR–LATERAL VIEW

Upper **leg**

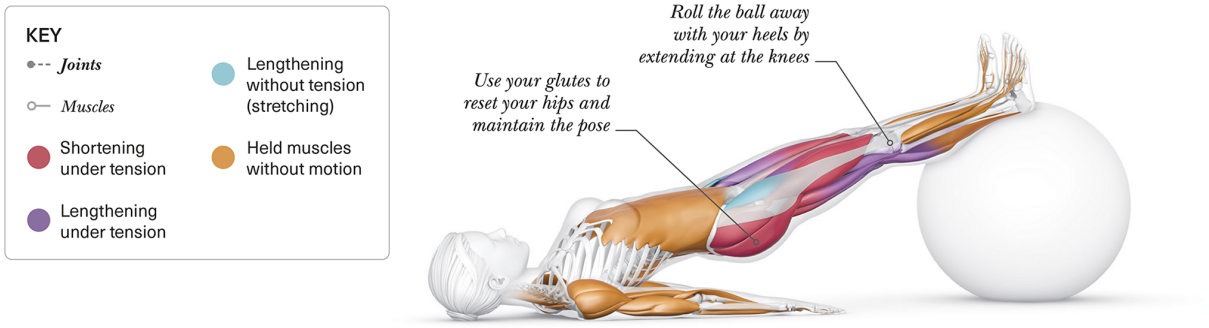
The **hamstrings** contract concentrically to flex the knees. Dig your heels into the ball and focus on raising the knees rather than pulling the ball toward you. The **glutes** work to maintain the bridge position and lengthen as your hip flexes. The **hip flexors** engage concentrically to flex your hip. The **gastrocnemius** contracts concentrically to flex the knee and pull the heels up toward the body.

Upper **body**

Your **arms** act as a counterbalance, allowing your upper body to remain stable and prevent rotation. Your **core** works to maintain balance on the ball and to support your lower back.

STAGE TWO

Breathe in and slowly roll the ball back to its starting position with your knees and hips extended. Hold this position for a moment to reset your breathing, hip position, and torso stability for the next rep. Repeat stages 1 and 2.



ℹ Double-tap image to read the labels

LEG EXTENSION

This exercise specifically trains the quadriceps as you flex and extend your legs at the knees. It is a great machine-based exercise, even for beginners, because it safely isolates and effectively loads the quadriceps in their shortened position.

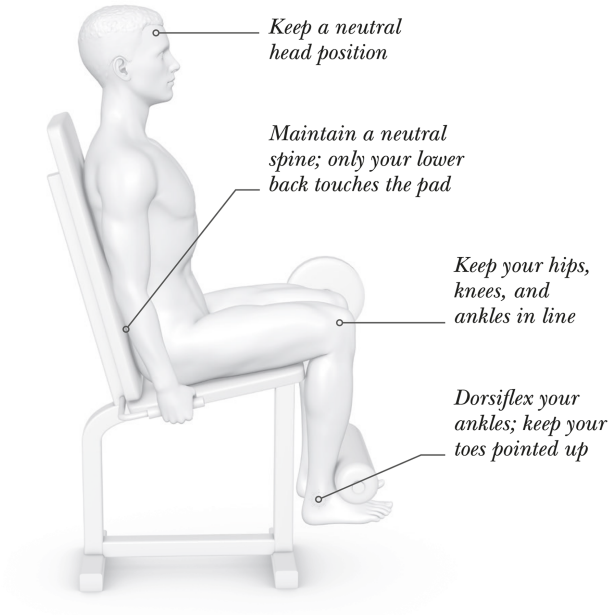
THE BIG PICTURE

Adjust the back pad so that, when sitting, your knee wraps naturally around the seat pad; this position aligns your knees with the machine's axis of rotation. Start the rep slowly and accelerate into the top position. The return move should also be controlled.

Beginners can start with 4 sets of 8–10 reps; discover other variations and other targeted sets in the training programmes.

PREPARATORY STAGE

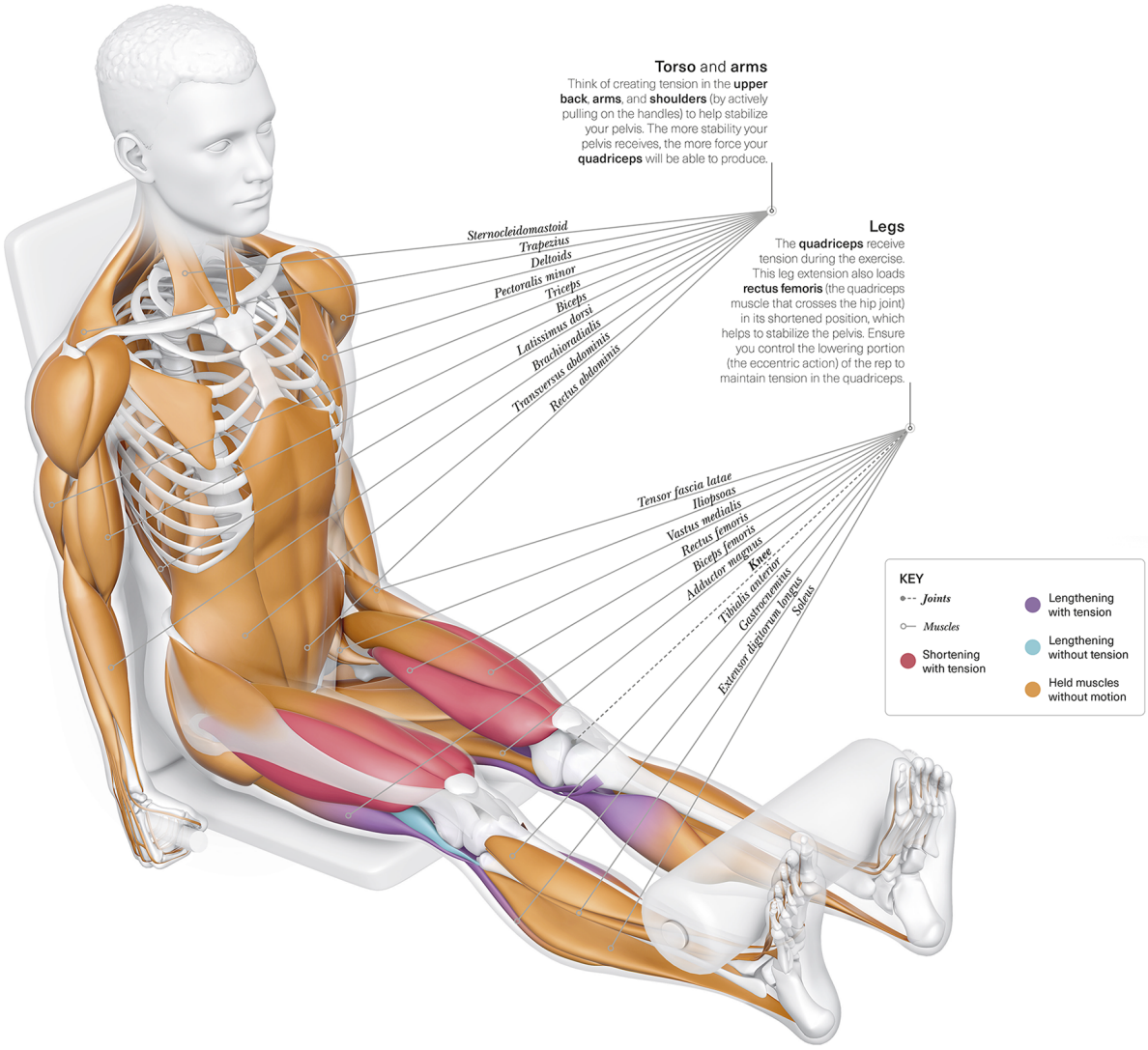
Set the weights and sit in the machine with your knees bent and ankles beneath an ankle pad; adjust the ankle pad so that it touches just above your shoes. Grip the handles and pull down into the seat pad to stabilize your pelvis throughout. Breathe in.



Double-tap image to read the labels

STAGE ONE

Breathe out as you slowly extend at the knees, raising the ankle pad, then accelerate into the rep until you reach the end of your knees' range of extension (this varies by person). Dorsiflex your ankles throughout. The goal is fully contracted quadriceps. For an extra challenge, hold at the top for 1–2 seconds.



ℹ Double-tap image to read the labels

SUPERIOR-ANTERIOR-LATERAL VIEW

Torso and **arms**

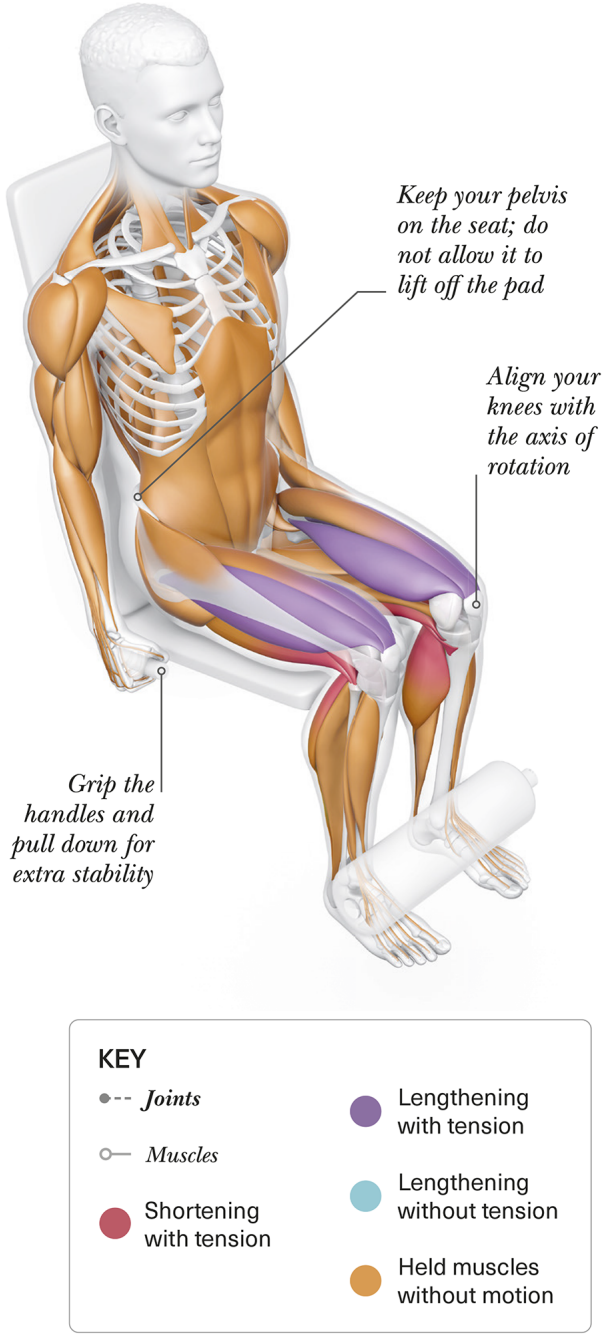
Think of creating tension in the **upper back**, **arms**, and **shoulders** (by actively pulling on the handles) to help stabilize your pelvis. The more stability your pelvis receives, the more force your **quadriceps** will be able to produce.

Legs

The **quadriceps** receive tension during the exercise. This leg extension also loads **rectus femoris** (the quadriceps muscle that crosses the hip joint) in its shortened position, which helps to stabilize the pelvis. Ensure you control the lowering portion (the eccentric action) of the rep to maintain tension in the quadriceps.

STAGE TWO

Keep your abs engaged with your lower back against the pad. Breathe in as you continue to pull yourself down into the seat and slowly flex at the knees in a controlled fashion to return the ankle pad to its starting position. Reset your breathing and repeat stages 1 and 2.



Double-tap image to read the labels

Common mistakes

Rushing the movement – such as by flinging up the ankle pad – opens you up to injury and could take away tension from the target muscles. Coming out of your seat on each rep shows that you're not sufficiently stabilizing your torso and pelvis.

VARIATIONS

At first glance, these leg extension variations can look easy. But, when performed correctly, each of these exercises packs a punch, isolating the quadriceps and challenging them in their shortened range – which is not an easy movement to replicate.

UNILATERAL LEG EXTENSION

This exercise gives you the ability to challenge one leg at a time. Such unilateral movements can be great for those who are building muscle and strength back after an injury or period off training. As with all single limb movements, be sure to repeat equally on the other side.

PREPARATORY STAGE

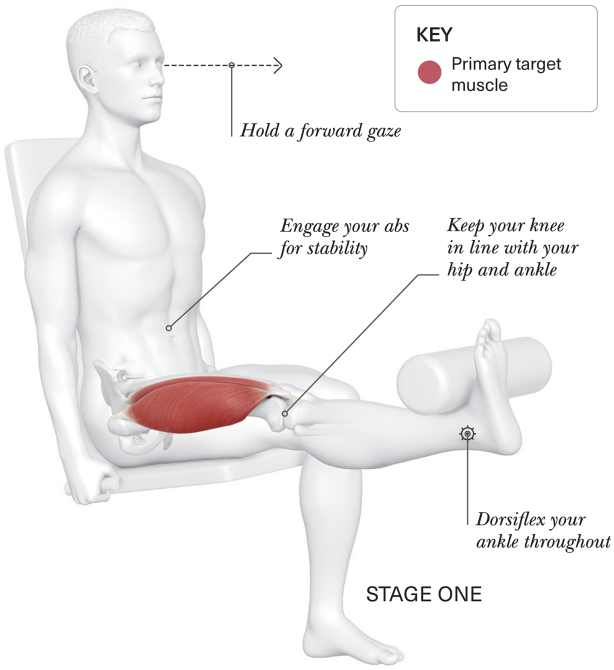
Set up the machine. Sit against the back pad with one knee bent around the seat. Place your other foot under the ankle pad. Hold the grips and pull down.

STAGE ONE

Breathe out and, while flexing your ankle, extend the knee of the working leg to lift the ankle pad. Keep a neutral spine and your abs engaged.

STAGE TWO

Breathe in, while continuing to pull down on the handles, to return your working leg to the starting position under control. Repeat on your other leg.



Double-tap image to read the labels

UNILATERAL CUFFED LEG EXTENSION

This exercise uses a cable pulley machine with a cuff but can be swapped out for a free-standing resistance band. The loading reduces as you go through the concentric part (stage 1), which is not ideal. To counteract that you can add a hold or squeeze for 1–4 seconds at the top position.

PREPARATORY STAGE

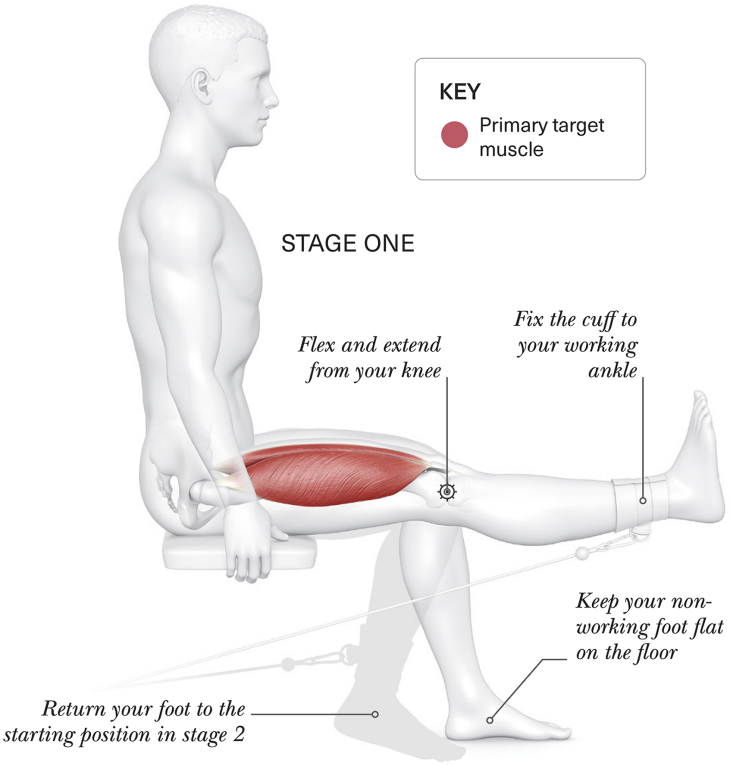
Set up the cable from a low setting and attach the cuff to your working ankle. Sit tall with a neutral spine and with your glutes fully on the bench.

STAGE ONE

Breathe out, dorsiflex your ankle, and extend your working leg at the knee to lift your foot, working against the resistance of the cable as you do so.

STAGE TWO

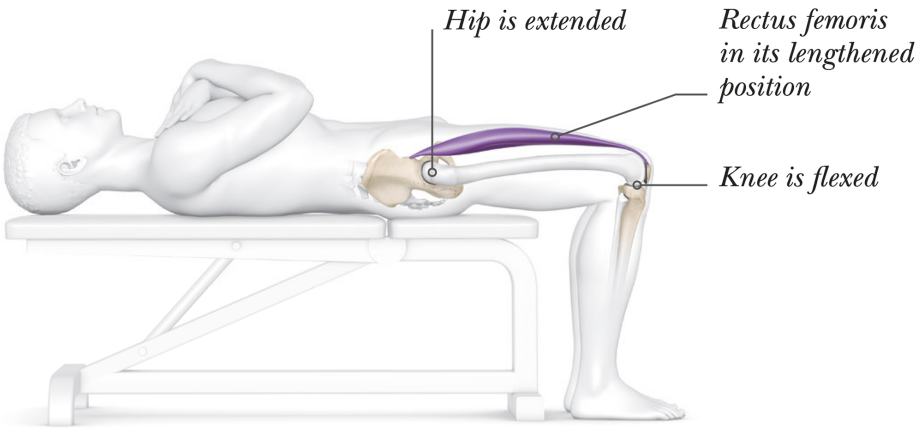
Still gripping the bench, breathe in to slowly return your leg to the starting position. Complete the reps then switch the cuff and repeat on your other leg.



Double-tap image to read the labels

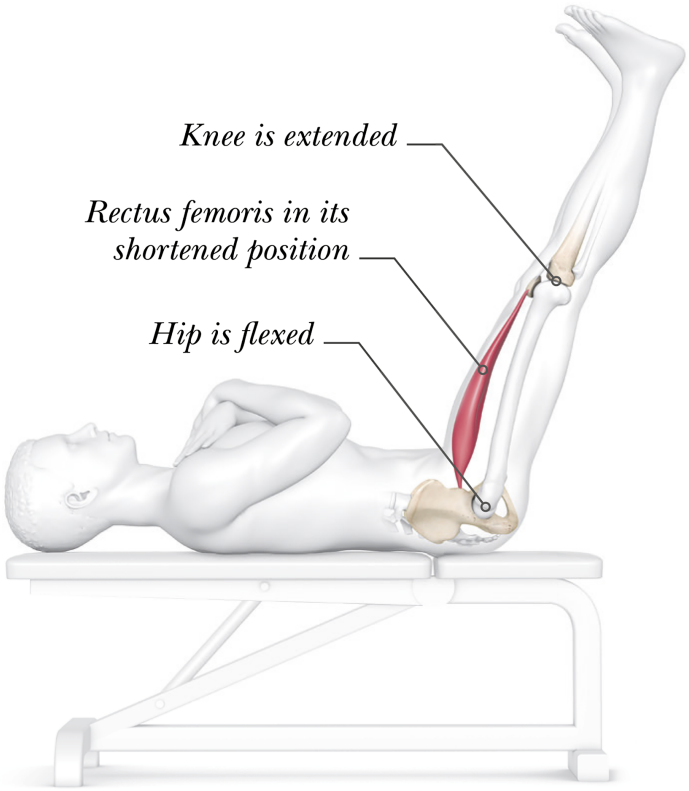
Targeting the **rectus femoris**

The leg extension exercise is unique as it is the only way to fully shorten (contract) the rectus femoris. This quadriceps muscle crosses both the hip and the knee and is responsible for knee extension and hip flexion.



Double-tap image to read the labels

MAXIMAL EXTENSION



Double-tap image to read the labels

MAXIMAL SHORTENING

BANDED LYING LEG EXTENSION

This machine-free leg extension uses a resistance band and can easily be done at home or in the gym. You'll need to choose an appropriate band and be sure to find a stable anchor point to fix it to.

PREPARATORY STAGE

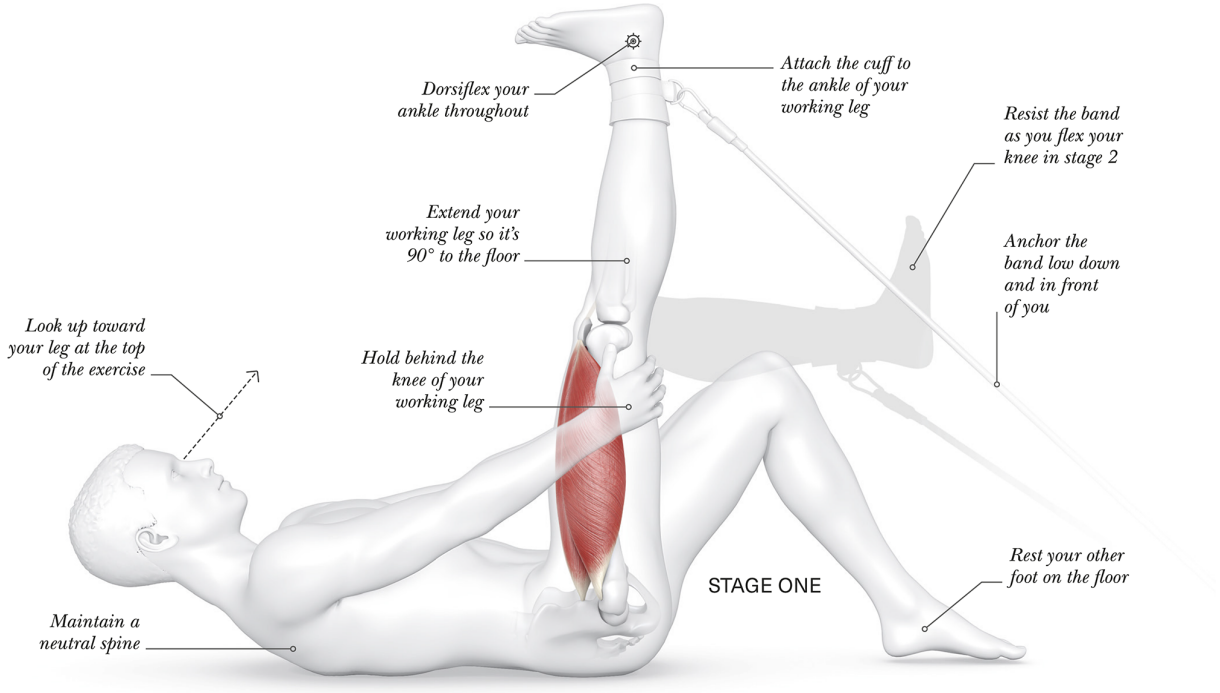
Fix the resistance band low and in front of you. Lie on your back with your non-working leg flexed and the band attached to your working leg's ankle.

STAGE ONE

With your ankle flexed and your knee supported, breathe out and extend the knee of your working leg so it's straight up. Hold for 1–4 seconds in this position.

STAGE TWO

Inhale while slowly flexing your leg just at the knee, resisting the band with control. Complete the reps, then switch the ankle cuff and repeat on your other leg.



Double-tap image to read the labels

BARBELL GLUTE BRIDGE

Also commonly referred to as the hip thrust, this exercise trains the glutes as you flex and extend the hips. Like the leg extension for the quadriceps, this exercise loads the glutes in their shortened position, without the need to load the spine.

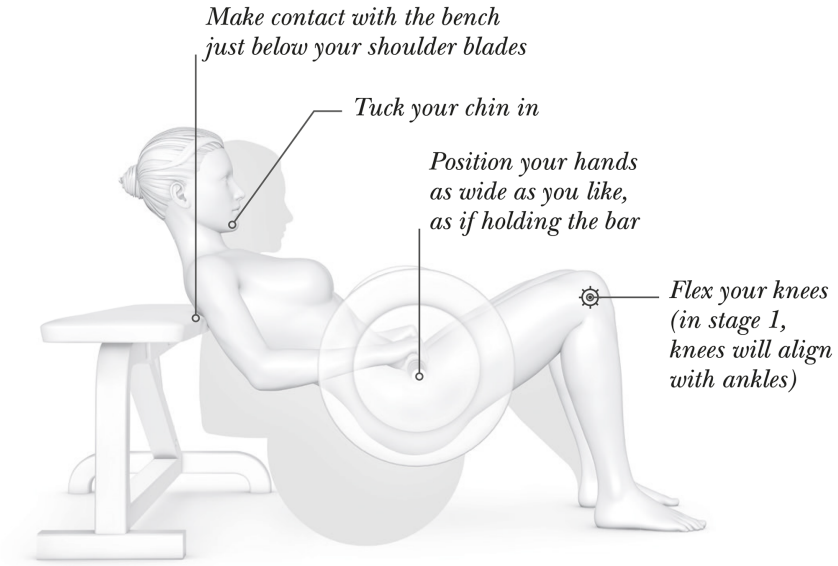
THE BIG PICTURE

You will need a sturdy bench or step to lean on. You carry the barbell in your hip crease as you extend and flex your hips, lifting and lowering your body; if you find the barbell uncomfortable, add a pad. Correct alignment of your feet, ankles, and knees is important for ease of movement and avoiding injury.

Beginners can start with 4 sets of 8–10 reps; discover other variations and other targeted sets in the training programmes.

PREPARATORY STAGE

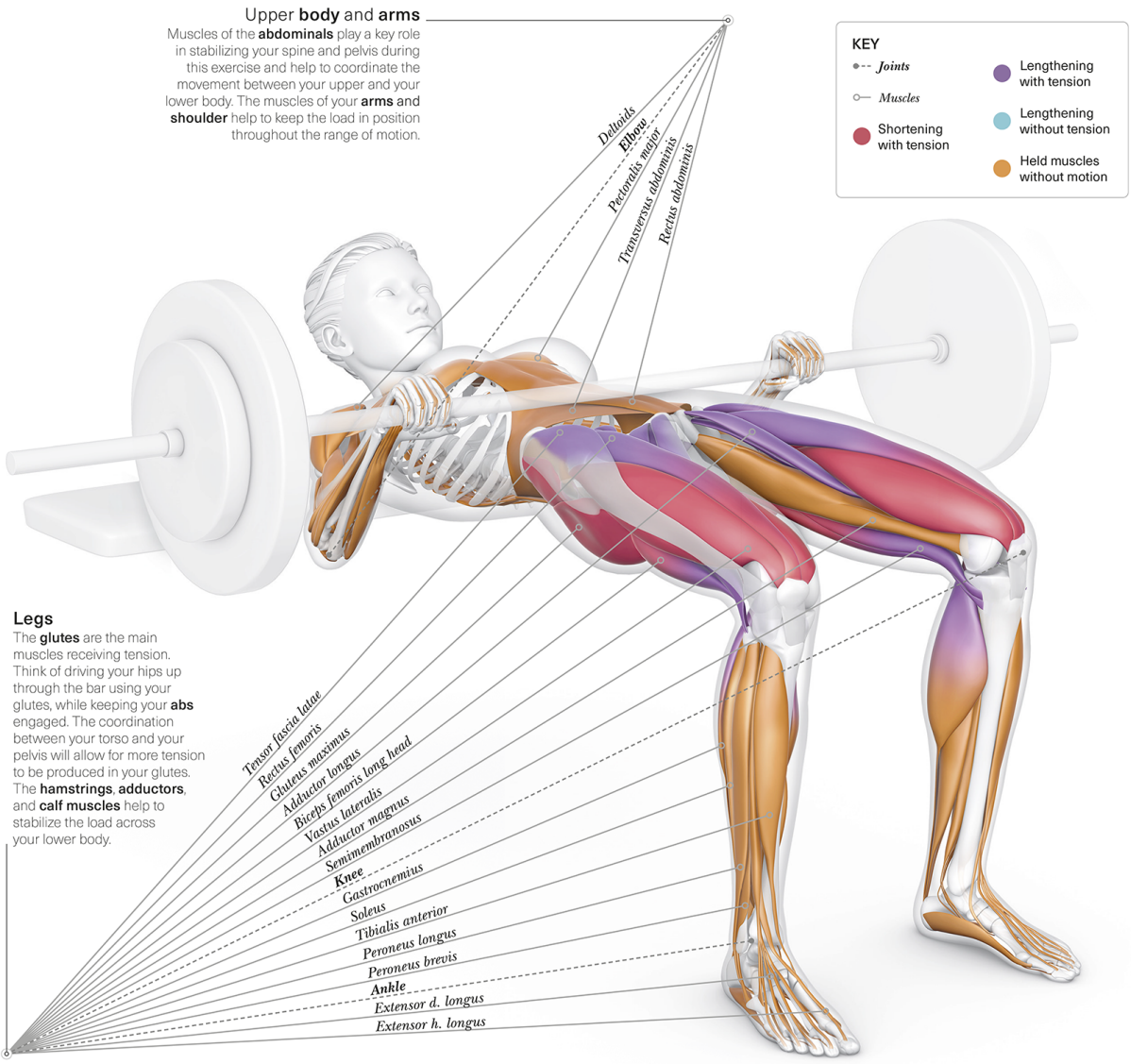
Sit with your back on the bench with your legs flexed and feet just outside of shoulder-width apart. With the barbell in your hip crease, engage your glutes to push your hips up off the floor into the top starting position. Breathe in to engage your core.



ⓘ Double-tap image to read the labels

STAGE ONE

Place tension in the glutes and abdominals. Breathe out while driving your feet through the floor and driving the barbell upward, so that your torso becomes parallel with the floor. To add intensity and more challenge to the rep, hold at the top for 1–2 seconds while actively contracting the glutes.



ℹ Double-tap image to read the labels

ANTERIOR-LATERAL VIEW

Legs

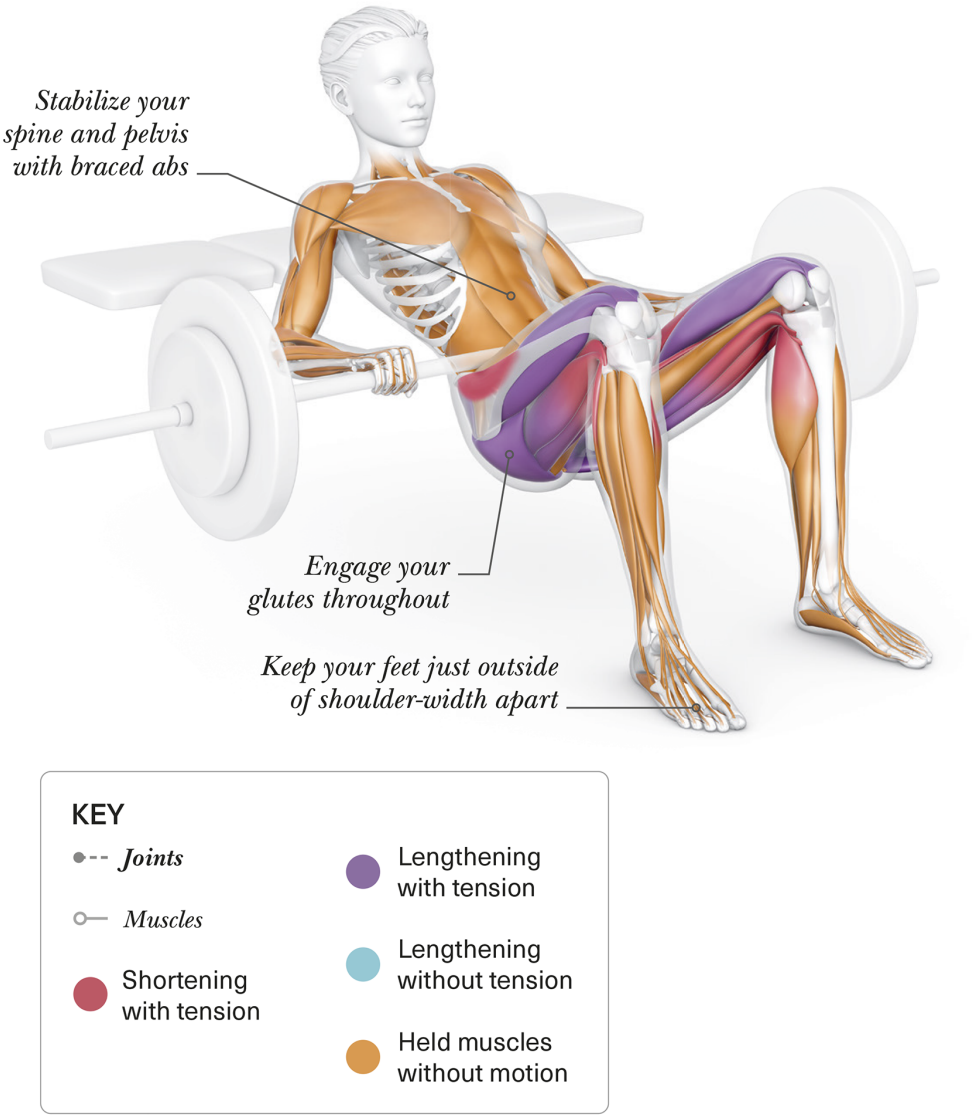
The **glutes** are the main muscles receiving tension. Think of driving your hips up through the bar using your glutes, while keeping your **abs** engaged. The coordination between your torso and your pelvis will allow for more tension to be produced in your glutes. The **hamstrings**, **adductors**, and **calf muscles** help to stabilize the load across your lower body.

Upper **body** and **arms**

Muscles of the **abdominals** play a key role in stabilizing your spine and pelvis during this exercise and help to coordinate the movement between your upper and your lower body. The muscles of your **arms** and **shoulder** help to keep the load in position throughout the range of motion.

STAGE TWO

As you lower the bar with control to the starting position, keep your abdominals engaged and chin tucked in. When you feel your knees start to track backward from being aligned over your ankles, you've reached the bottom of the rep. Pause for 1 second to reset breathing then repeat stages 1 and 2.



Double-tap image to read the labels

Common mistakes

Do not go too low when in the starting position; as soon as your knees start to track backward, stop. The hips should move downward only, not back.

VARIATIONS

These exercises all target the glutes, as well as isolating the function of hip extension via the hamstrings. Training unilaterally can be particularly effective, as it allows you to increase the intensity of the exercise, putting greater tension on the glutes in your working leg.

DUMBBELL GLUTE BRIDGE

Much like the main exercise on the previous pages, this variation follows the same movement but uses a dumbbell instead. Working with a smaller load helps you to improve your execution before progressing to heavier weights.

PREPARATORY STAGE

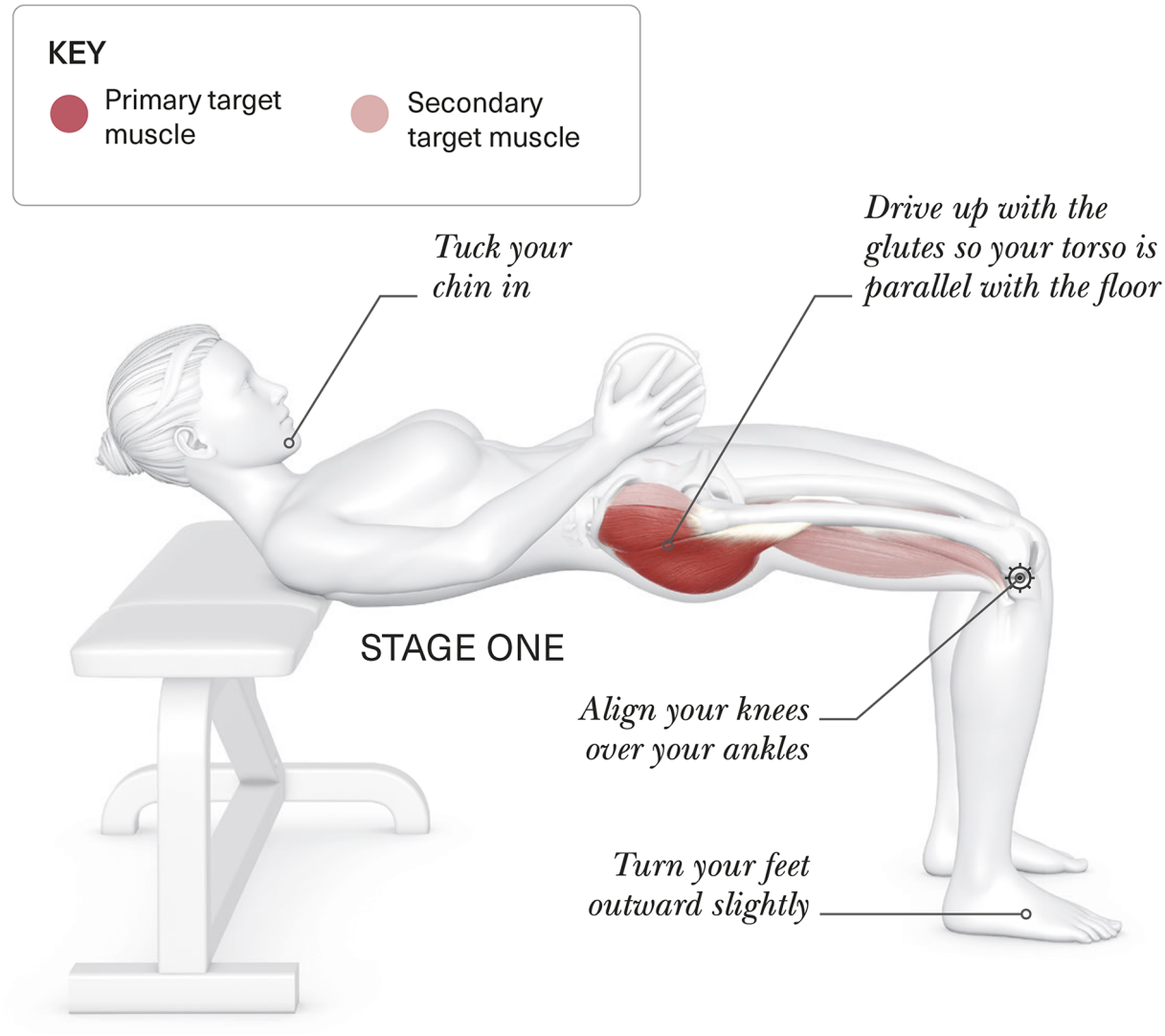
Lean back on the bench with your legs flexed. Place the dumbbell in your hip crease and engage the glutes to lift your hips slightly off the floor.

STAGE ONE

With tension in the glutes and abs, breathe out while driving your torso and the dumbbell upward. Hold at the top for 1–2 seconds, if possible.

STAGE TWO

Keep your abs engaged and chin tucked in as you lower your torso to the starting position. Pause here briefly before repeating stages 1 and 2.



Double-tap image to read the labels

STANDING CABLE GLUTE KICKBACK

Use this variation in conjunction with other glute exercises if you don't have access to free weights or would like to add isolated volume to the glutes. Make sure you do not round at your lower back or use momentum to kick the weight back.

PREPARATORY STAGE

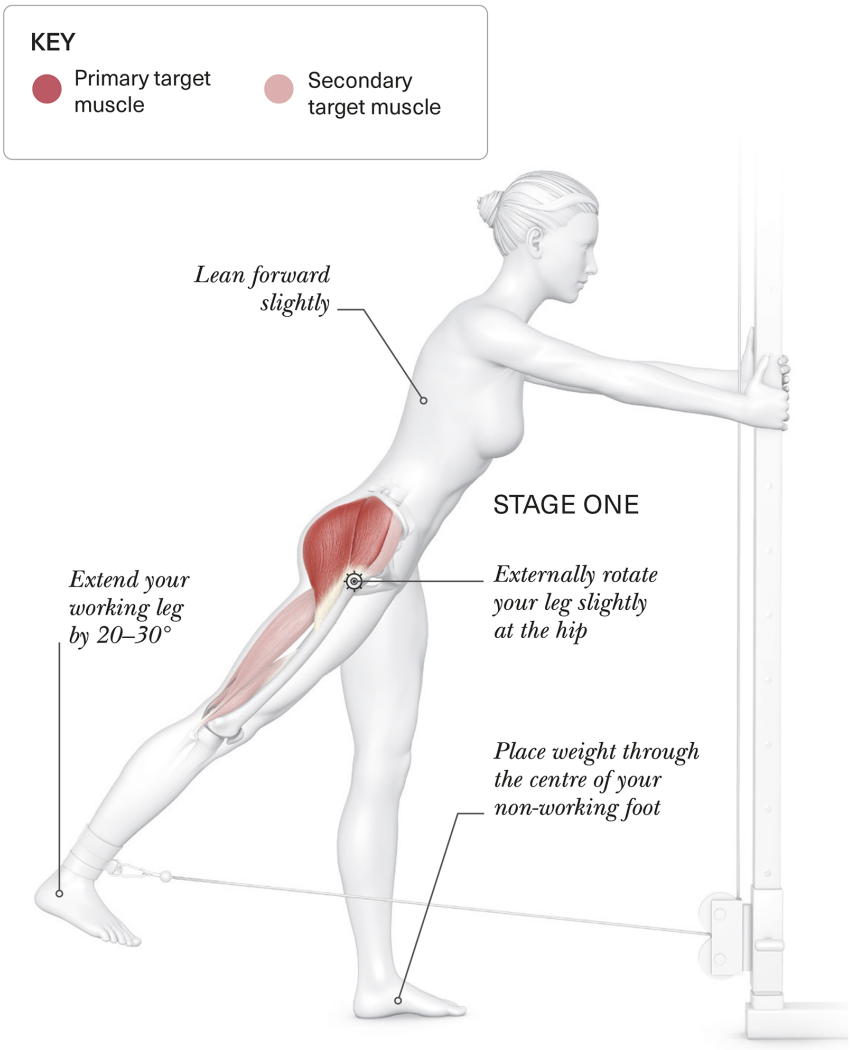
Place the cable strap around your ankle, above the shoe. Stand with your feet hip-width apart and place your hands on the cable machine to stabilize yourself.

STAGE ONE

Breathe in to engage your abs. Then breathe out as you kick your leg back, abducting it to around 20–30°. For added challenge, hold for 1–2 seconds.

STAGE TWO

Keep your abs engaged and spine neutral as you return to the starting position with control, while breathing in. Repeat stages 1 and 2.



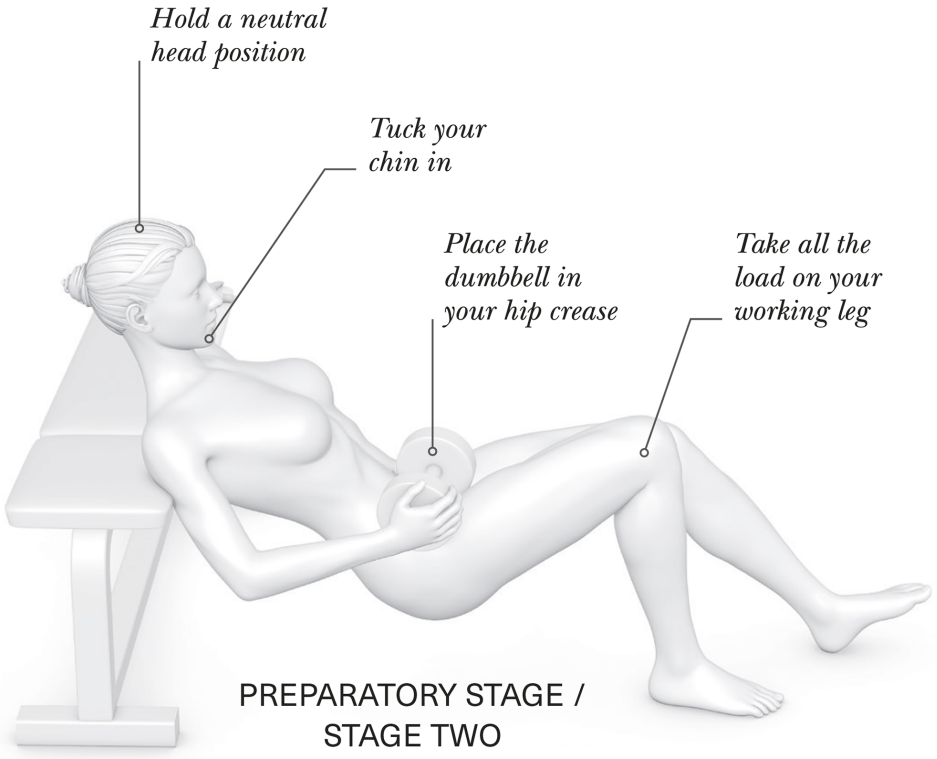
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SINGLE-LEG GLUTE BRIDGE

If weight is limited or you want to increase the challenge, this single-leg option may be useful. By performing the exercise using one leg at a time, you raise the intensity of the load for your working leg; it can be performed with or without weights. Do keep track of the reps so that you can work each leg equally.

PREPARATORY STAGE

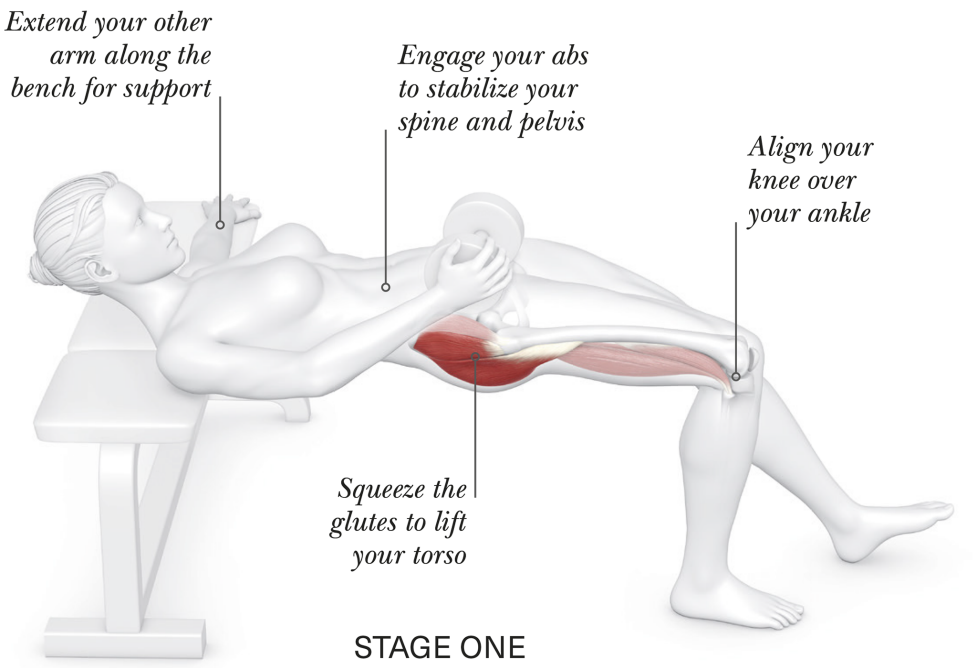
Lean back on the bench with your working leg flexed and the other resting on its heel in front. Engage the glutes to lift your hips slightly off the floor.



ℹ Double-tap image to read the labels

STAGE ONE

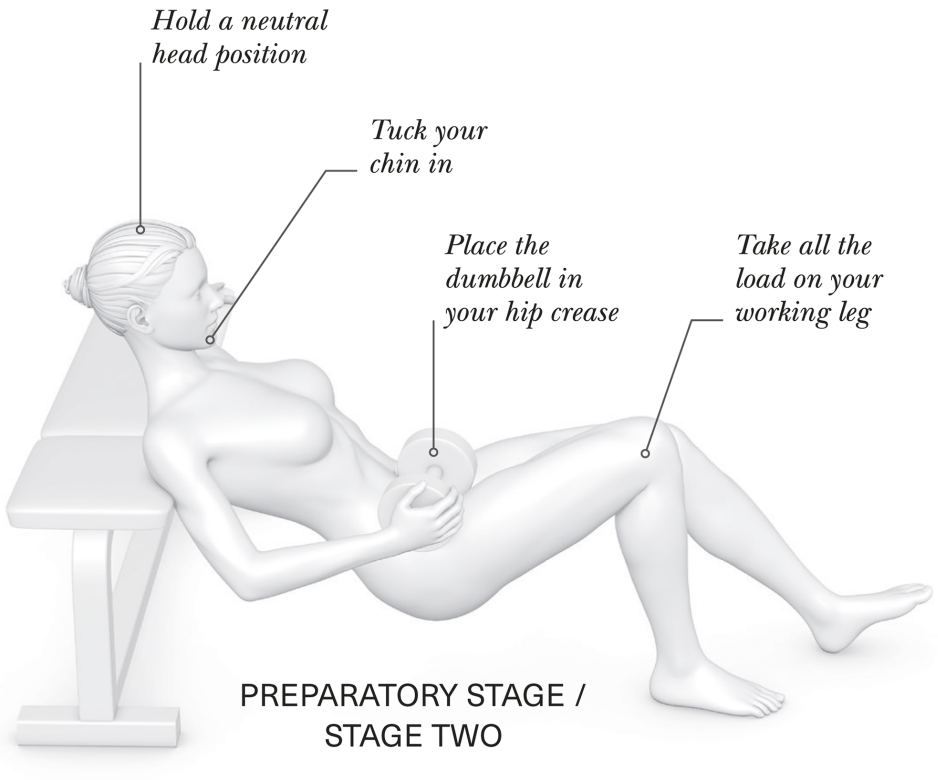
Keep tension in the glutes and abs and breathe out while driving your torso upward using your working leg only. Hold for 1–2 seconds for an extra challenge.



Double-tap image to read the labels

STAGE TWO

Slowly lower your torse to the starting position, while keeping your abs engaged and chin tucked in. Pause here briefly before repeating stages 1 and 2.



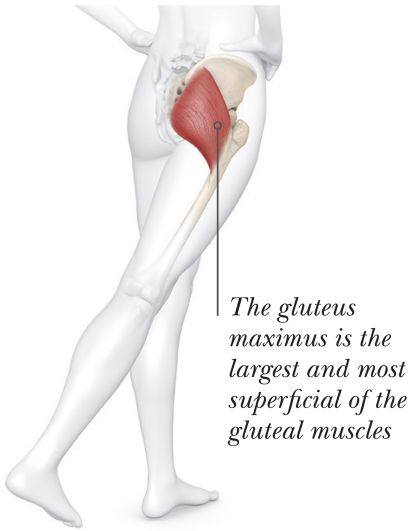
Double-tap image to read the labels

The trio of **gluteal** muscles

The glutes act as key players in hip stability and strength during activities such as walking, jumping, sprinting, and strength training. The gluteus maximus, medius, and minimus help the hip extend, externally and internally rotate, and abduct. Strong and functional glutes can help alleviate lower-back pain and make everyday movements, such as standing, walking, and climbing the stairs, that much easier.

GLUTEUS MAXIMUS

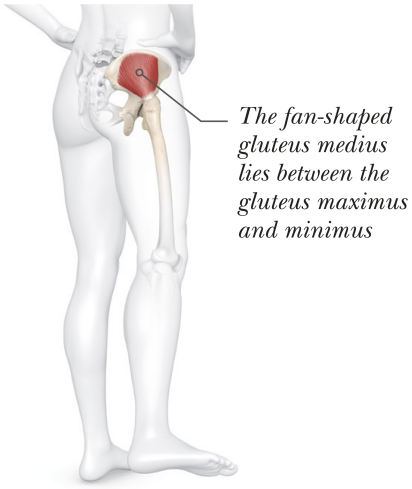
This muscle works to extend the hip posteriorly and rotate the leg.



Double-tap image to read the labels

GLUTEUS MEDIUS

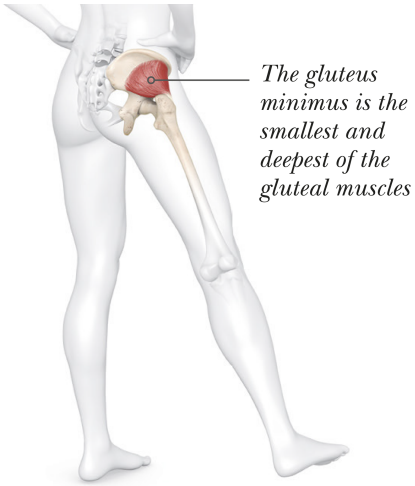
This supports g. maximus in extending the hip more laterally, and rotating the leg.



Double-tap image to read the labels

GLUTEUS MINIMUS

This muscle supports g. maximus in extending the hip more laterally.



Double-tap image to read the labels

CALF RAISE

This machine-based exercise trains the gastrocnemius and soleus muscles of the calf in their role of plantar flexion (standing on tiptoes) and also works the Achilles tendon. Calf strength can help maintain a healthy knee.

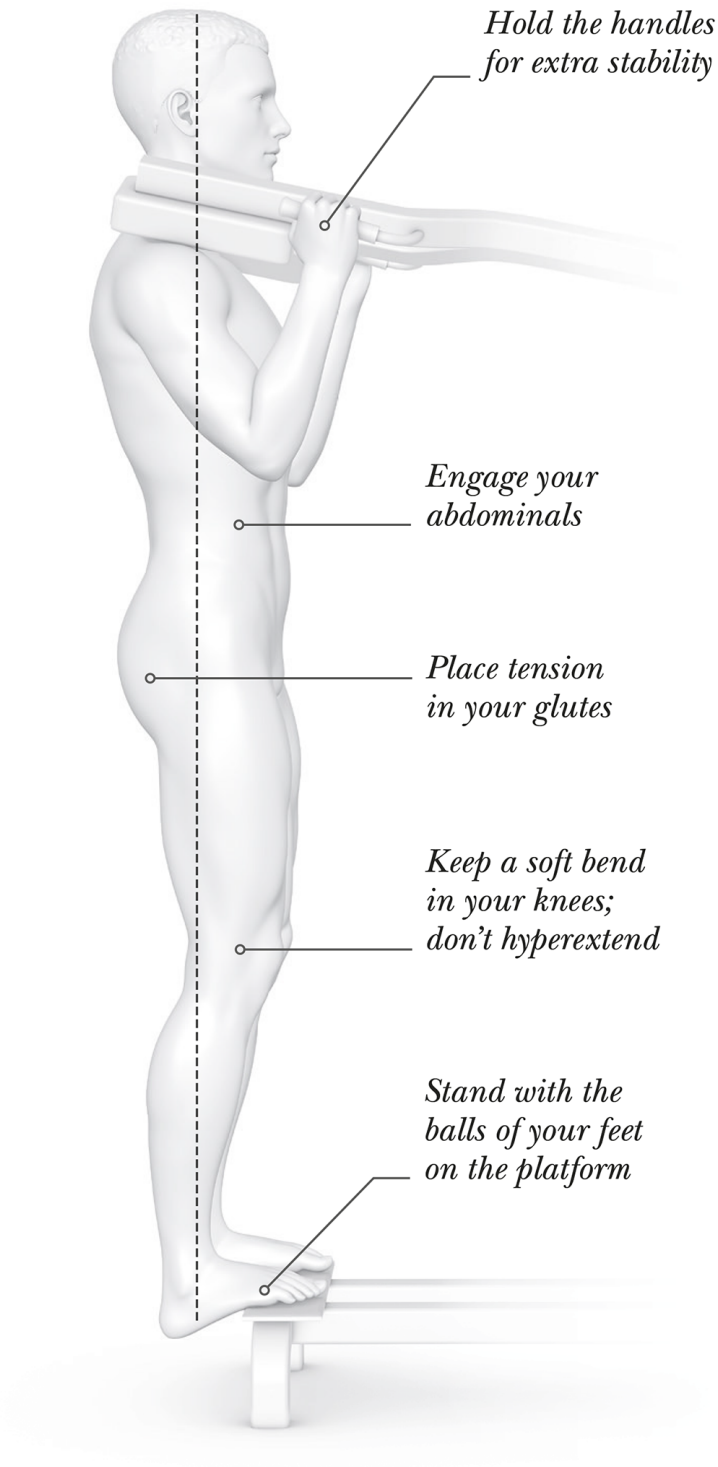
THE BIG PICTURE

On the bar, your feet should be parallel and the balls of your feet in full contact with the bar while you raise yourself up onto tiptoes and then lower into a heel drop. Your feet can be parallel or slightly turned out – whatever is most comfortable. Proper execution is crucial and the movement should be slow and controlled. Keep tension in the leg muscles while allowing a "soft lockout" (an ever so slight bend in the knees) to avoid hyperextension (fully pushed back position).

Beginners can start with 4 sets of 8–10 reps; discover other variations and other targeted sets in the training programmes.

PREPARATORY STAGE

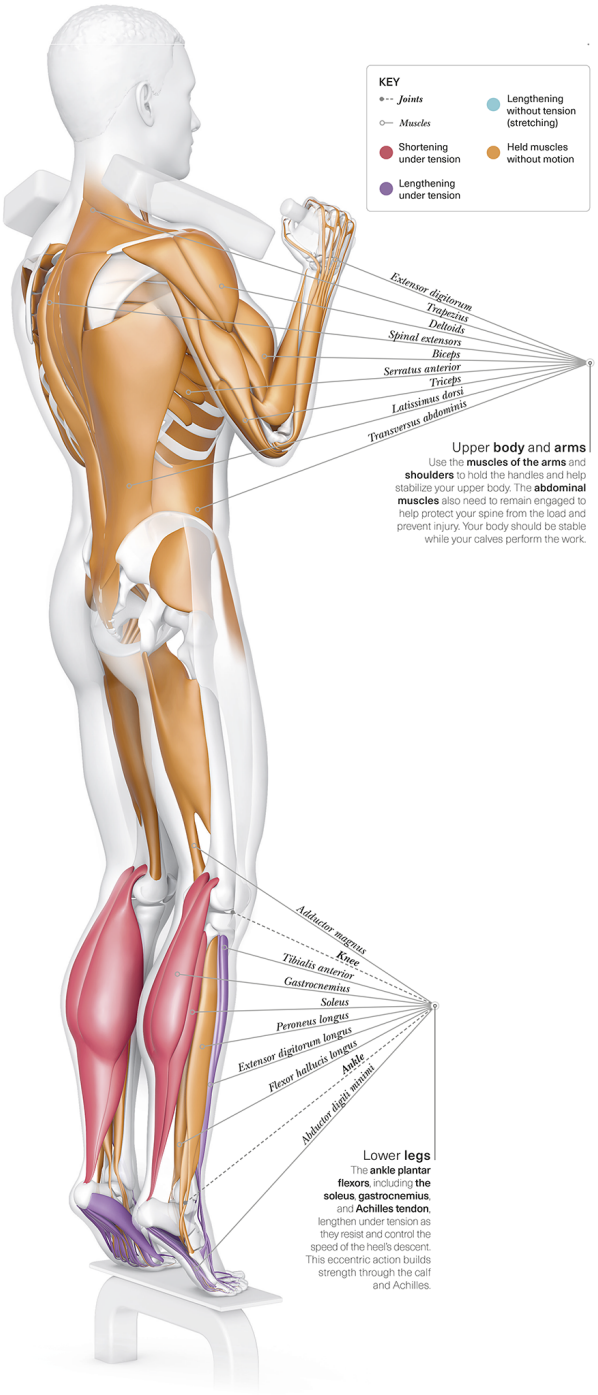
Set the weights, place your shoulders under the pads, and stand with the balls of your feet on the edge of the step, feet hip-width apart. Ensure your torso and pelvis are stable throughout. Now, lower your heels into the starting position.



Double-tap image to read the labels

STAGE ONE

Take a breath in to help stabilize your core. Breathe out as you contract your calf to raise your heels in a slow, controlled movement till you're standing on tiptoes. Keep your ankles in line with your knees throughout.



ℹ Double-tap image to read the labels

POSTERIOR-LATERAL VIEW

Upper **body** and **arms**

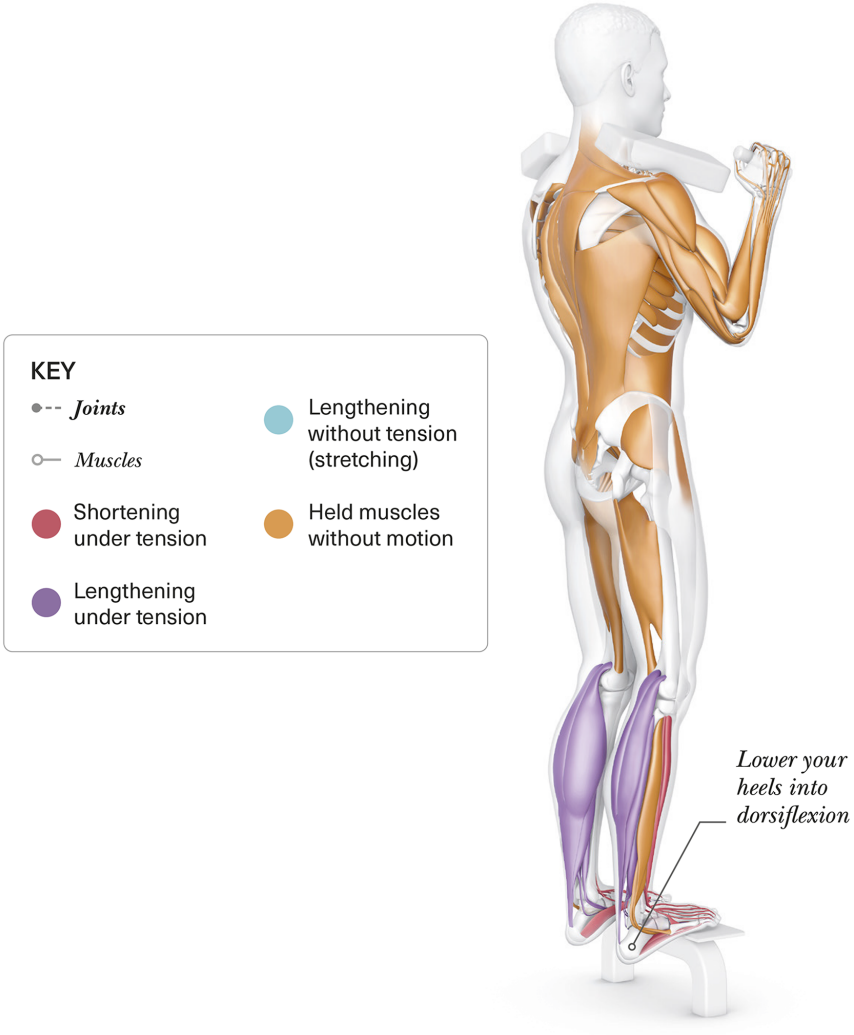
Use the **muscles of the arms** and **shoulders** to hold the handles and help stabilize your upper body. The **abdominal muscles** also need to remain engaged to help protect your spine from the load and prevent injury. Your body should be stable while your calves perform the work.

Lower **legs**

The **ankle plantar flexors**, including **the soleus**, **gastrocnemius**, and **Achilles tendon**, lengthen under tension as they resist and control the speed of the heel's descent. This eccentric action builds strength through the calf and Achilles.

STAGE TWO

Breathe in and slowly lower your heels as far as they will go in a smooth, controlled move. Pause for 1–2 seconds at the bottom to release passive tension in the Achilles tendon. Reset your breathing; repeat stages 1 and 2 in a rhythmic way.



ℹ Double-tap image to read the labels

Common mistakes

Rolling out the ankles on the raise can put stress on the Achilles tendon, so keep your ankles in line with your knees. Don't bend your knees to create momentum for the raise as that won't effectively challenge your calf.

VARIATIONS

Strengthening the calf helps to maintain a healthy and stable knee joint. As with the calf raise on the previous pages, these variations target the gastrocnemius and soleus muscles and work the Achilles tendon.

SEATED CALF RAISE

Performing this exercise in a seated position biases the soleus muscle over the gastrocnemius, because your knees are flexed. This seated calf raise adds variety to your routine whether you're at home or in the gym.

PREPARATORY STAGE

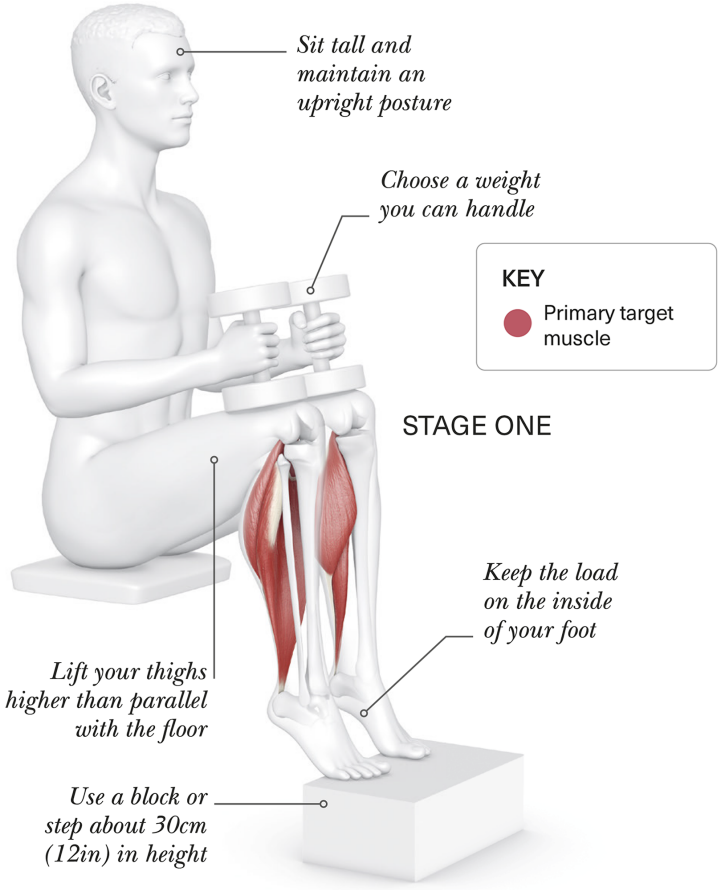
Sit tall with your feet hip-width apart and resting on the balls of your feet on a block or step in front of you. Rest the dumbbells on your knees.

STAGE ONE

Breathe in to engage your core. Breathe out as you contract your calves to raise your heels, driving your feet up and ankles forward, with control.

STAGE TWO

Breathe in and slowly lower your heels, keeping your ankles in line with your knees throughout. Pause at the bottom of each rep. Repeat stages 1 and 2.



Double-tap image to read the labels

SINGLE-LEG CALF RAISE

No extra weights are needed in this unilateral variation because supporting your bodyweight on one leg during its calf raise is enough load. Be sure to work each leg evenly.

PREPARATORY STAGE

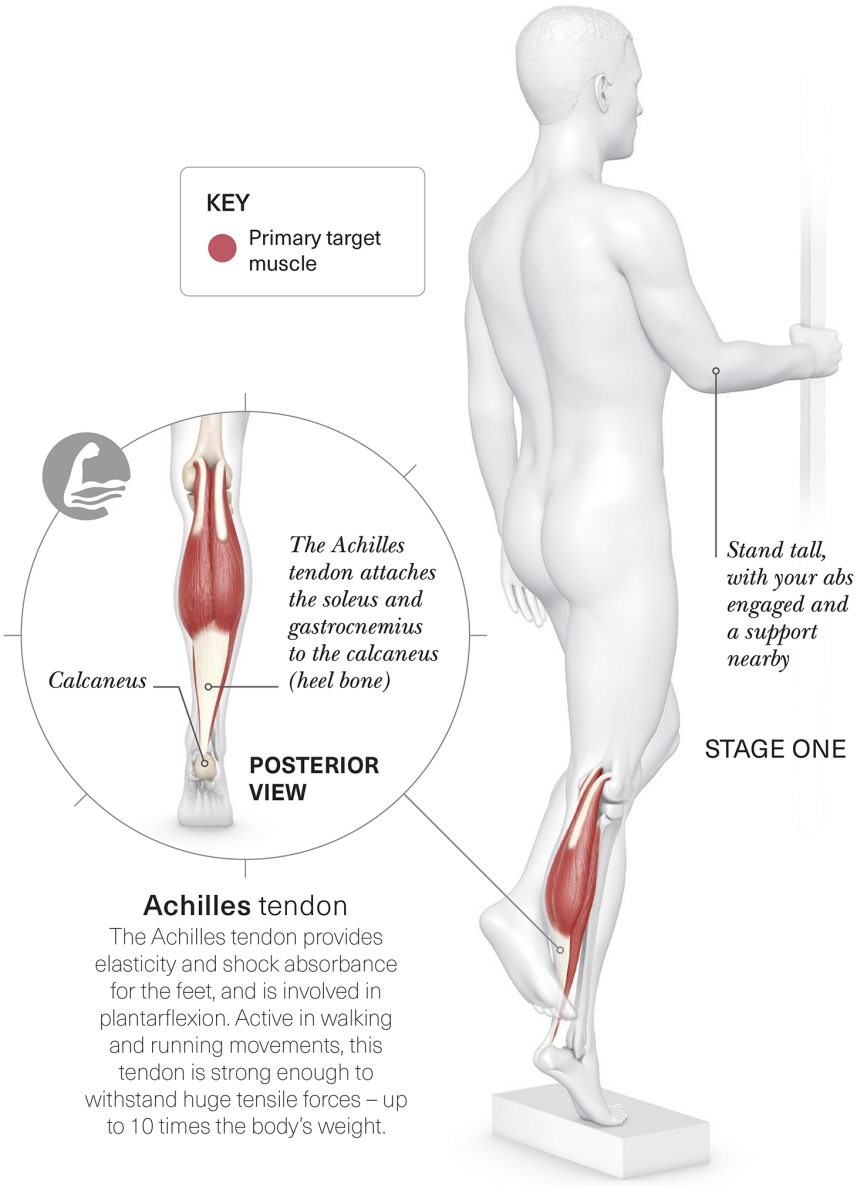
Stand tall. Place the ball of one foot on the step and wrap your non-working leg around the back of the other. Lower your heel into the starting position.

STAGE ONE

Breathe in to engage your core. Breathe out as you raise your heel as you contract your calf. Have a support nearby to hold if balance is an issue.

STAGE TWO

Breathe in and lower your heel in a controlled manner, keeping the load on the inside of your foot. Hold the bottom position then repeat stages 1 and 2.



Double-tap image to read the labels

POSTERIOR VIEW

Achilles tendon

The Achilles tendon provides elasticity and shock absorbance for the feet, and is involved in plantarflexion. Active in walking and running movements, this tendon is strong enough to withstand huge tensile forces – up to 10 times the body's weight.

*“Training the **calf** muscles not only **adds size and strength** to the lower leg, but also aids in **increasing stability at the knee**.”*

LEG PRESS CALF RAISE

This variation emulates the calf raise but allows for your body to be in a more stable position and without any load on your spine. It's a great alternative for anyone who may feel unstable or uncomfortable using a standing calf raise machine.

PREPARATORY STAGE

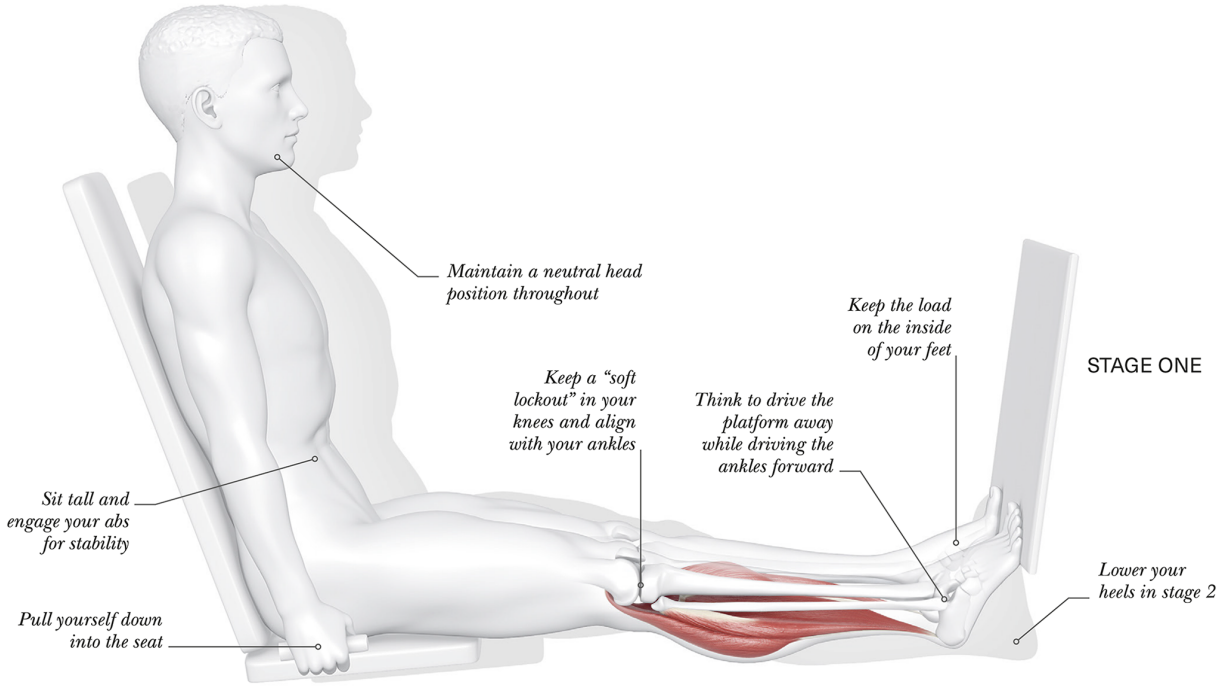
Set the weight. Sit on the seat with the balls of your feet hip-width apart on the platform, and your heels lowered.

STAGE ONE

Inhale to engage your core, and pull yourself down into the seat. Breathe out as you push the balls of your feet onto the platform so your heels rise.

STAGE TWO

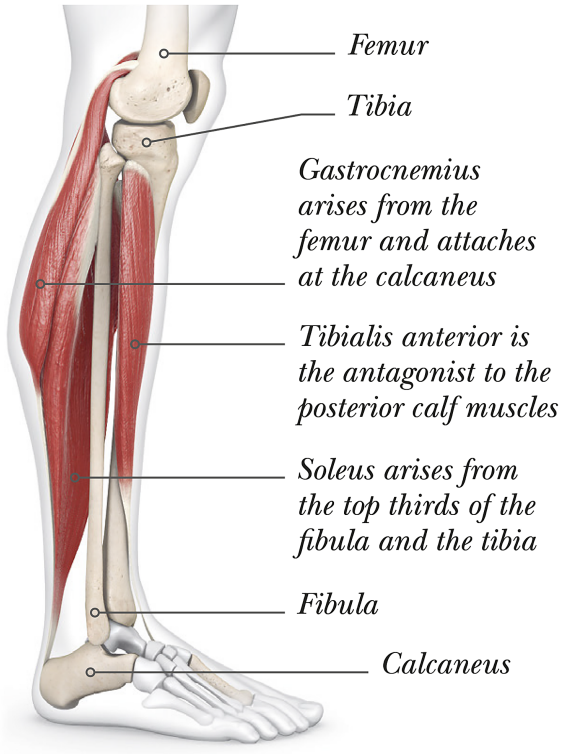
Breathe in and lower your heels to the starting position, maintaining control throughout. Pause at the bottom then repeat stages 1 and 2.



Double-tap image to read the labels

Ankle **dorsiflexion** and **plantarflexion**

The muscles of the ankle are important in their roles of dorsiflexion and plantarflexion. They also work alongside the muscles of the foot to stabilize gait and ensure healthy function of both the foot and the ankle. Proper training of the gastrocnemius, soleus, and other muscles of the lower leg help create a healthy movement pattern and prevent injuries in the long term.



Double-tap image to read the labels

LATERAL VIEW

TRADITIONAL **DEADLIFT**

This exercise helps train most of the muscles in the lower body while also challenging many upper-body muscle groups. Hip extension strengthens the glutes and hamstrings (known as the posterior chain), while knee extension trains the quadriceps. To stay safe, work on the mechanics of the movement before upping the load.

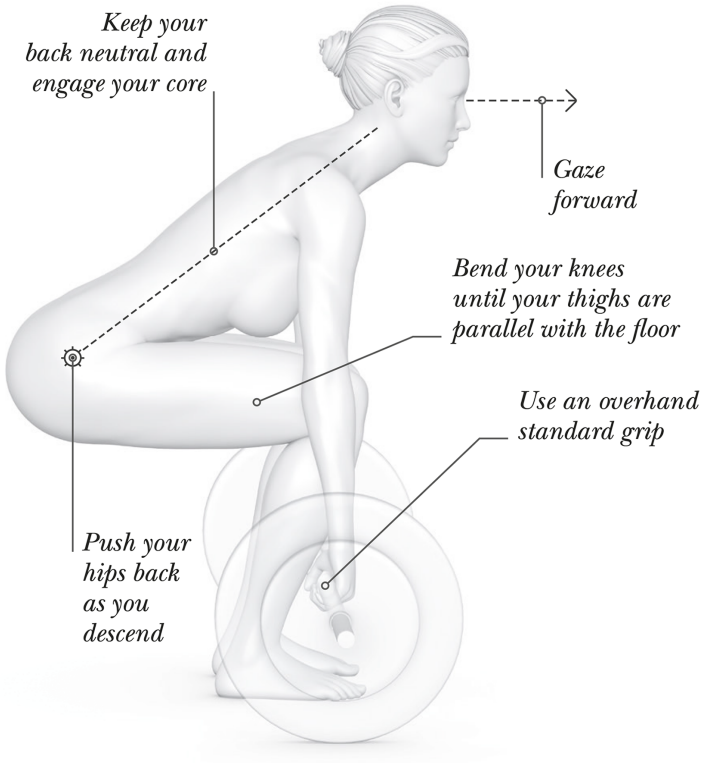
THE **BIG PICTURE**

You will need a barbell with full-size or bumper plates. Rather than thinking of lifting the bar, allow the upward movement generated by the quads, hamstrings, and glutes to raise the bar by driving down. Be sure to control the return move.

Beginners can start with 4 sets of 8–10 reps; discover other variations of this exercise on and other targeted sets within the training programmes.

PREPARATORY STAGE

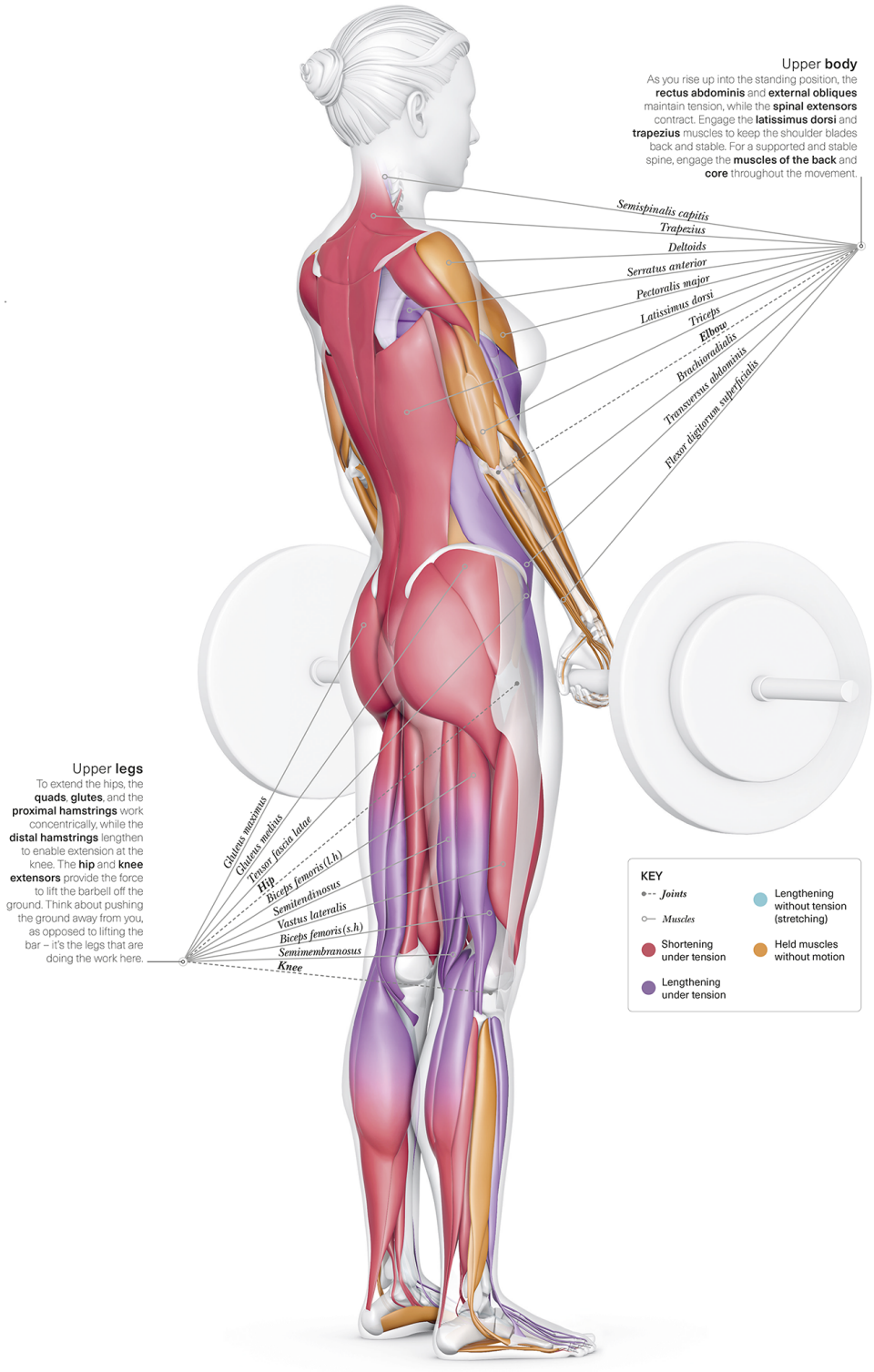
Stand centrally along the bar with your feet roughly shoulder-width apart and angled slightly outward. Push your hips back and bend your knees as you reach for the bar; your shins will be close to the bar. Keep a neutral spine, with your shoulders back and upper-back muscles engaged.



Double-tap image to read the labels

STAGE ONE

Breathe in and brace your upper body and core. Drive through the floor with your quads and power your hips forward as you reach the top of the lift, breathing out as you do so. Hold briefly to check your stability.



ℹ Double-tap image to read the labels

POSTERIOR-LATERAL VIEW

Upper **body**

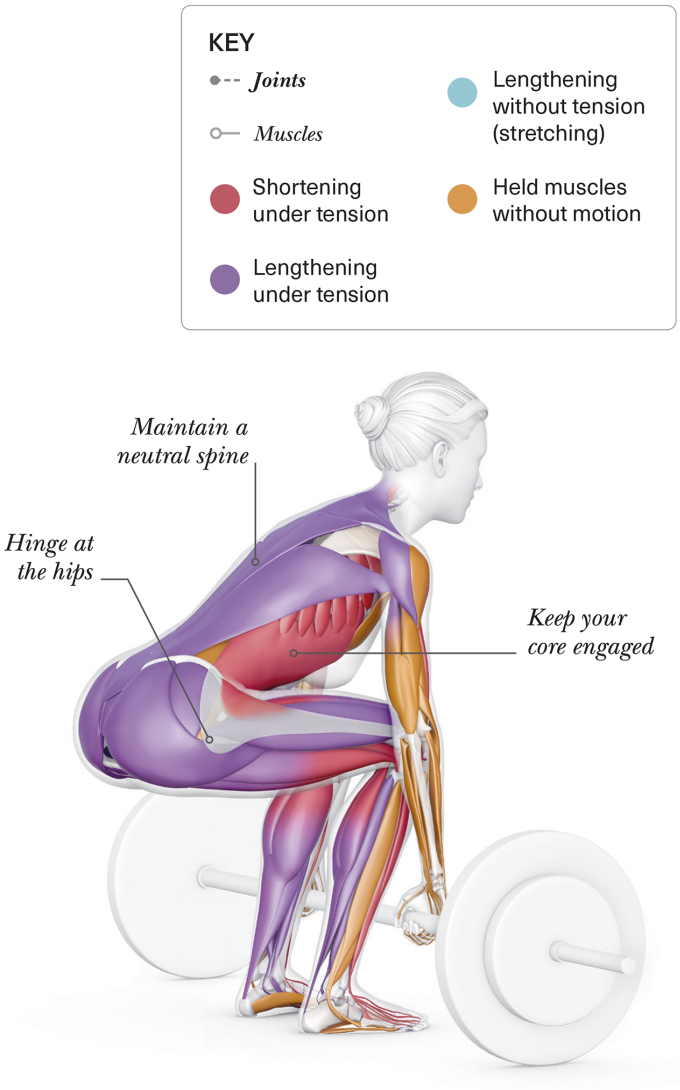
As you rise up into the standing position, the **rectus abdominis** and **external obliques** maintain tension, while the **spinal extensors** contract. Engage the **latissimus dorsi** and **trapezius** muscles to keep the shoulder blades back and stable. For a supported and stable spine, engage the **muscles of the back** and **core** throughout the movement.

Upper **legs**

To extend the hips, the **quads**, **glutes**, and the **proximal hamstrings** work concentrically, while the **distal hamstrings** lengthen to enable extension at the knee. The **hip** and **knee extensors** provide the force to lift the barbell off the ground. Think about pushing the ground away from you, as opposed to lifting the bar – it's the legs that are doing the work here.

STAGE TWO

As you hinge at the hip, controlling the descent of the bar, return to the starting position. Keep a neutral head position, looking forward throughout. Reset your breathing and balance before repeating stages 1 and 2.



ℹ Double-tap image to read the labels

Common mistakes

Not engaging your core and stabilizing your upper body throughout the movement can result in lower-back strain. Be sure to start with a low weight.

VARIATIONS

All these variations of the traditional deadlift on the previous pages also work the glutes, quads, spinal erectors, and the muscles of the upper back and torso. Such deadlift movement pattern exercises are popular to include in strength training programmes since they train so many muscles.

BANDED DEADLIFT

This variation loads the same muscles as the main exercise but allows you to perform the deadlift movement pattern while under resistance. For extra challenge, you can hold dumbbells with the resistance band (see image).

PREPARATORY STAGE

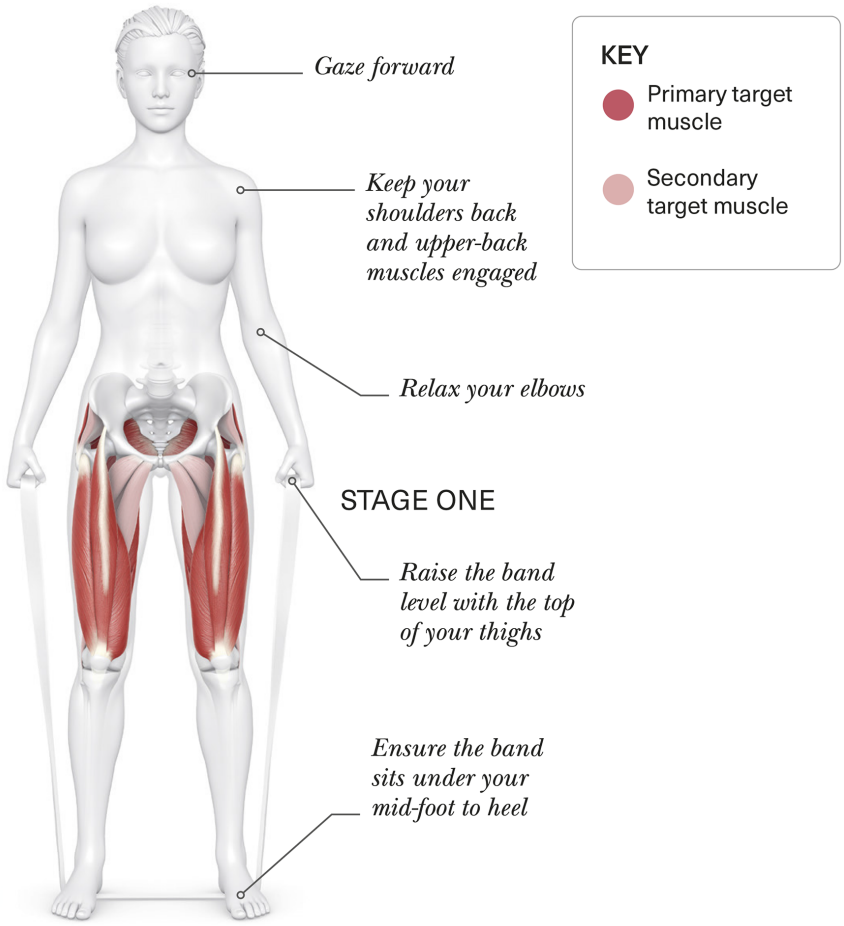
Choose an appropriate resistance band. Stand on the band with your feet shoulder-width apart. Bend to hold the band at knee level.

STAGE ONE

Breathe in and engage your core. Then drive through the floor with your quads while pushing your hips forward, breathing out as you do so.

STAGE TWO

Hinge at the hip to descend into the starting position, keeping a forward gaze and working against the resistance throughout. Repeat stages 1 and 2.



ℹ Double-tap image to read the labels

TRAP BAR DEADLIFT

Using a trap bar helps to centralize the load throughout and keep the bias on the quads while still challenging the glutes. It's easier on the joints and easier to do, so can make a great choice for beginners looking to train their quads.

PREPARATORY STAGE

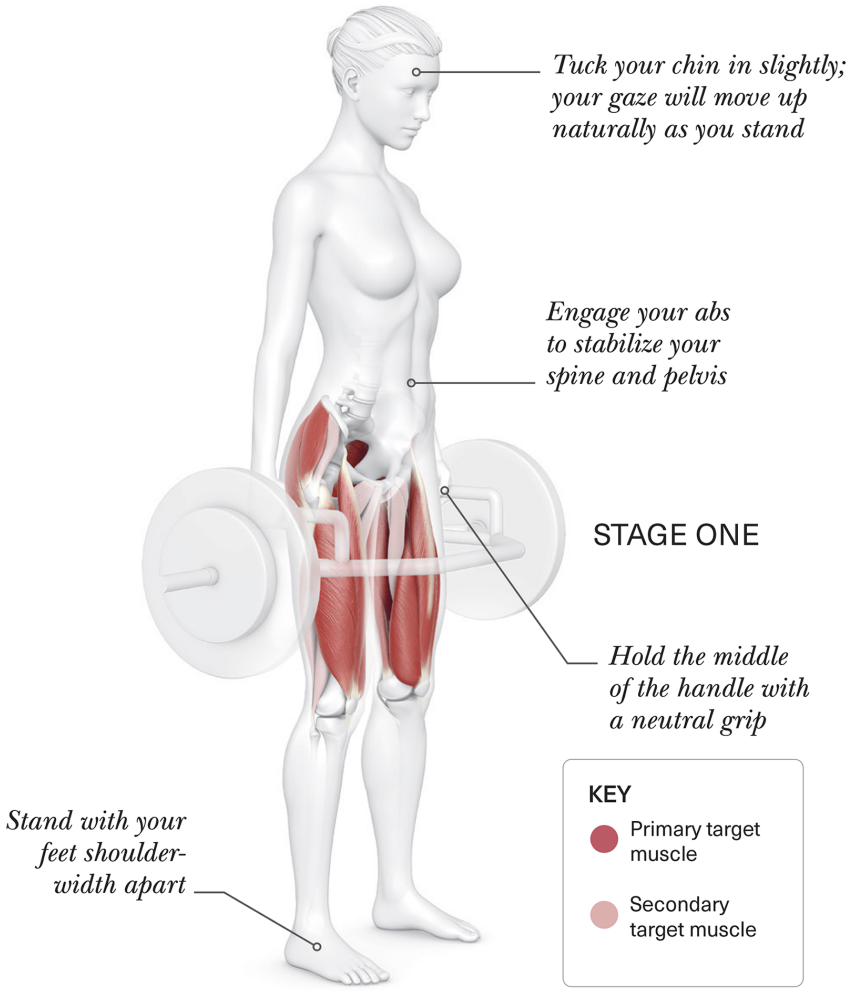
Set the weights and step into the trap bar (hex bar). Stand with feet angled outward slightly. Push your hips back to bend your knees and grip the handle.

STAGE ONE

Breathe in, engage your core, and power your hips forward to stand upright, breathing out as you do so. The bar travels in a straight line at 90° to the floor.

STAGE TWO

Push your hips back to return to the starting position, keeping your shoulders back and holding a forward gaze throughout. Repeat stages 1 and 2.



Double-tap image to read the labels

Spinal **alignment**

When performing any exercise with the deadlift movement pattern, it's essential to keep your spine in a neutral position, neither arching nor excessively rounding it. Engaging the abdominals stabilizes your spine and pelvis throughout the movement and protects against lower-back strain or injury.



Double-tap image to read the labels

ALIGNMENT



Double-tap image to read the labels

MISALIGNMENT



Double-tap image to read the labels

MISALIGNMENT

ROMANIAN DEADLIFT

This variation starts upright and then descends to the bent-over form. The hamstrings and glutes are the main hip extension muscles, controlling the descent into hip flexion and back into hip extension; the quads play a secondary role.

PREPARATORY STAGE

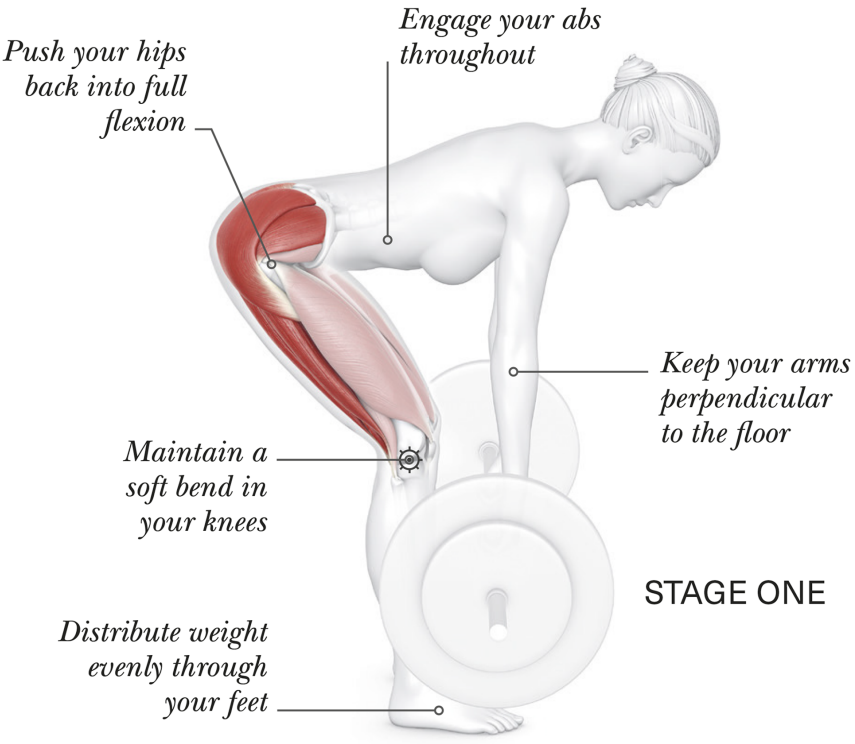
Stand in front of the barbell with your feet shoulder-width apart. Grip the bar at a comfortable width. Engage your core and drive into an upright position.

STAGE ONE

Breathe in and push your hips back into full flexion. Control the eccentric lowering phase while keeping a neutral head position and strong core.

STAGE TWO

Drive through the floor while pushing your hips forward, breathing out as you return to the upright starting position. Repeat stages 1 and 2.



Double-tap image to read the labels

CABLE DEADLIFT

The loading of this deadlift movement pattern using a cable pulley system will feel slightly different from that using a barbell. You move from a standing position to a squatting one. Be sure to start with a low weight and progress slowly.

PREPARATORY STAGE

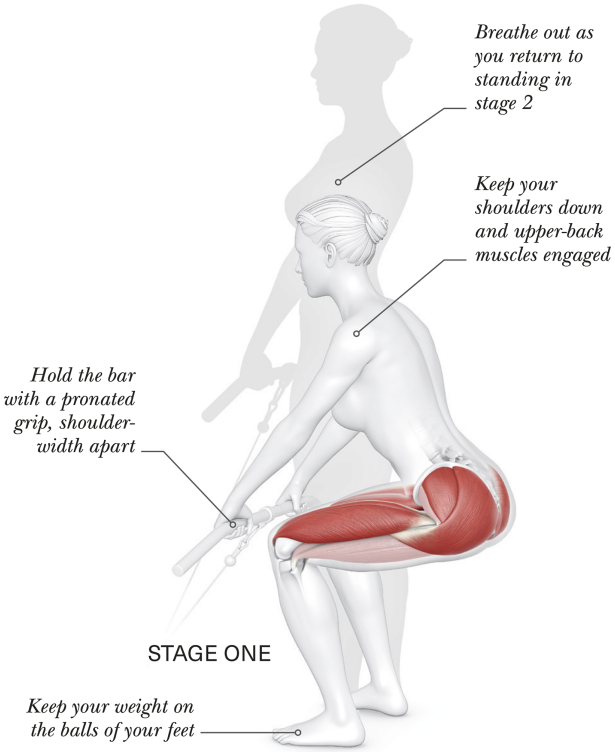
Face the pulley machine, pick up the attachment, and step back. Stand with your feet shoulder-width apart, angled slightly outward, and gaze forward.

STAGE ONE

Breathe in and push your hips back into full flexion, controlling the descent. Keep a neutral head position and strong core throughout.

STAGE TWO

From the lower position, power your hips forward and drive through the floor, breathing out as you return to the starting position. Repeat stages 1 and 2.



Double-tap image to read the labels

CHEST EXERCISES

The main muscles responsible for movement in the chest are: the pectoralis major, the muscle that creates the chest's surface shape; pectoralis minor, positioned deep beneath the pectoralis major and attaching to the ribcage and scapula; and the serratus anterior, also a deep muscle, attaching to the ribcage.

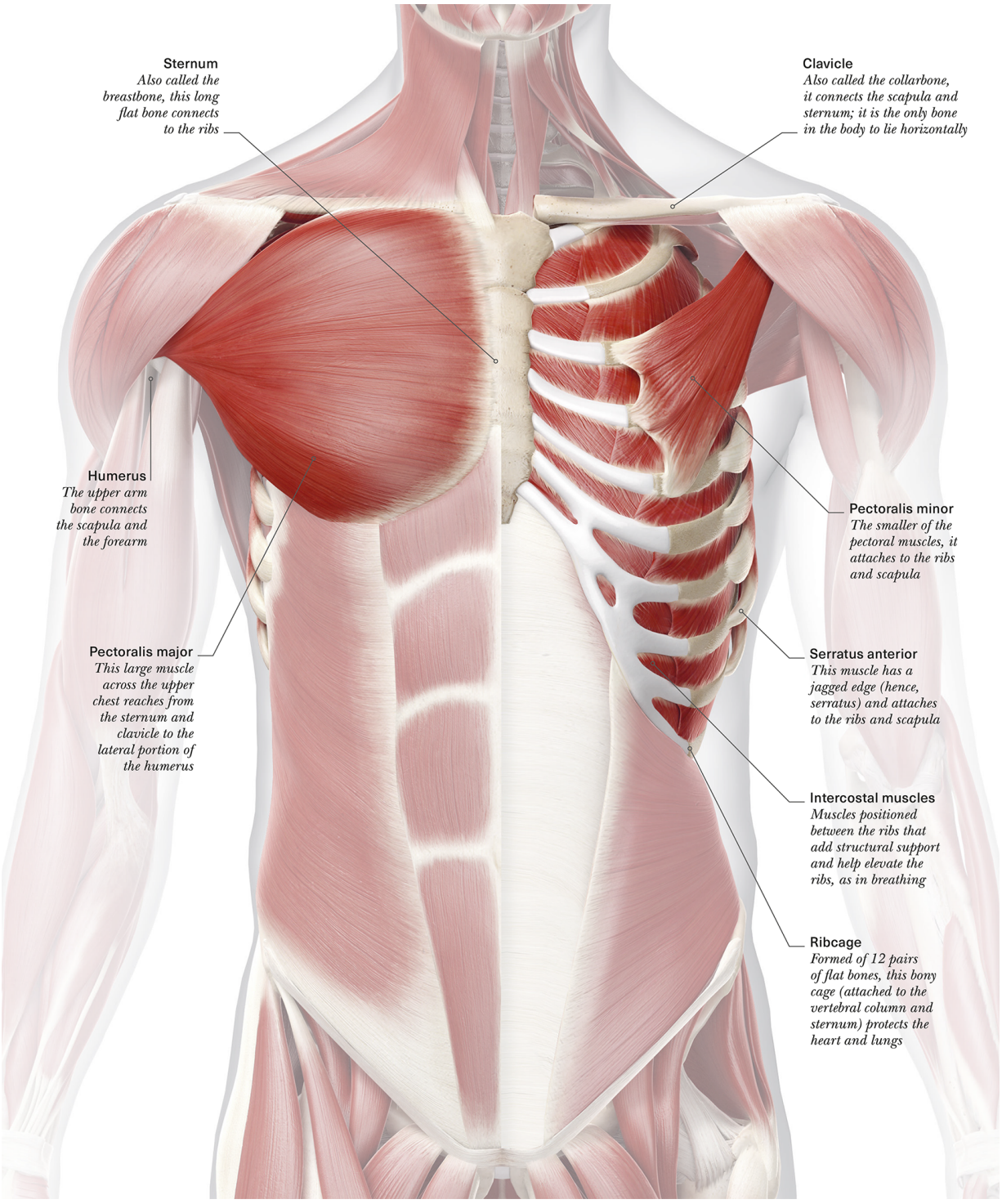
The pectoralis major functions around the shoulder joint, allowing a large and functional range of motion across the upper body. The pectoralis minor and serratus anterior help protract the shoulder forward during pressing and flying motions.

The main role of the pectorals (or pecs) in training is to aid in pulling the upper arm across the chest toward the midline of the body.

When performing horizontal pressing (such as the bench press), you will be integrating the pecs with the help of the deltoids and triceps to complete the range of motion. So, rather than think about just getting the load to the top of a movement, instead think how best to combine your pressing and driving actions.

When performing flying exercises, the deltoids and triceps will continue to lend their help but much less so. When flying, don't think about bringing the handles or dumbbells together as much as driving the upper arms in toward the sternum (middle of chest).

Pectoralis minor helps mainly with reaching forward during pressing and flying motions, aided by the serratus anterior. It also helps depress the shoulder in pulldowns.



ℹ Double-tap image to read the labels

SUPERFICIAL

Sternum
Also called the breastbone, this long flat bone connects to the ribs

Humerus
The upper arm bone connects the scapula and the forearm

Pectoralis major
This large muscle across the upper chest reaches from the sternum and clavicle to the lateral portion of the humerus

DEEP

Clavicle
Also called the collarbone, it connects the scapula and sternum; it is the only bone in the body to lie horizontally

Pectoralis minor
The smaller of the pectoral muscles, it attaches to the ribs and scapula

Serratus anterior
This muscle has a jagged edge (hence, serratus) and attaches to the ribs and scapula

Intercostal muscles
Muscles positioned between the ribs that add structural support and help elevate the ribs, as in breathing

Ribcage
Formed of 12 pairs of flat bones, this bony cage (attached to the vertebral column and sternum) protects the heart and lungs

*“Training **the chest** is not just about getting the weight to the top, it’s **pressing and driving in** the upper arm.”*

SECTION CONTENTS

Barbell bench press

Variations:

- Close-grip barbell bench press
- Incline barbell bench press
- Push-up

Dumbbell bench press

Variations:

- Unilateral dumbbell bench press
- Incline dumbbell bench press
- Banded chest press

High–low cable chest fly

Variations:

- High–low banded chest fly
- Mid-cable chest fly
- Low–high cable chest fly

Machine chest fly

Dumbbell chest fly

BARBELL BENCH PRESS

This is a classic chest exercise which involves lifting and lowering a barbell above your chest while lying on a bench. The dominant pressing movement trains muscles of the chest and shoulders as well as the triceps.

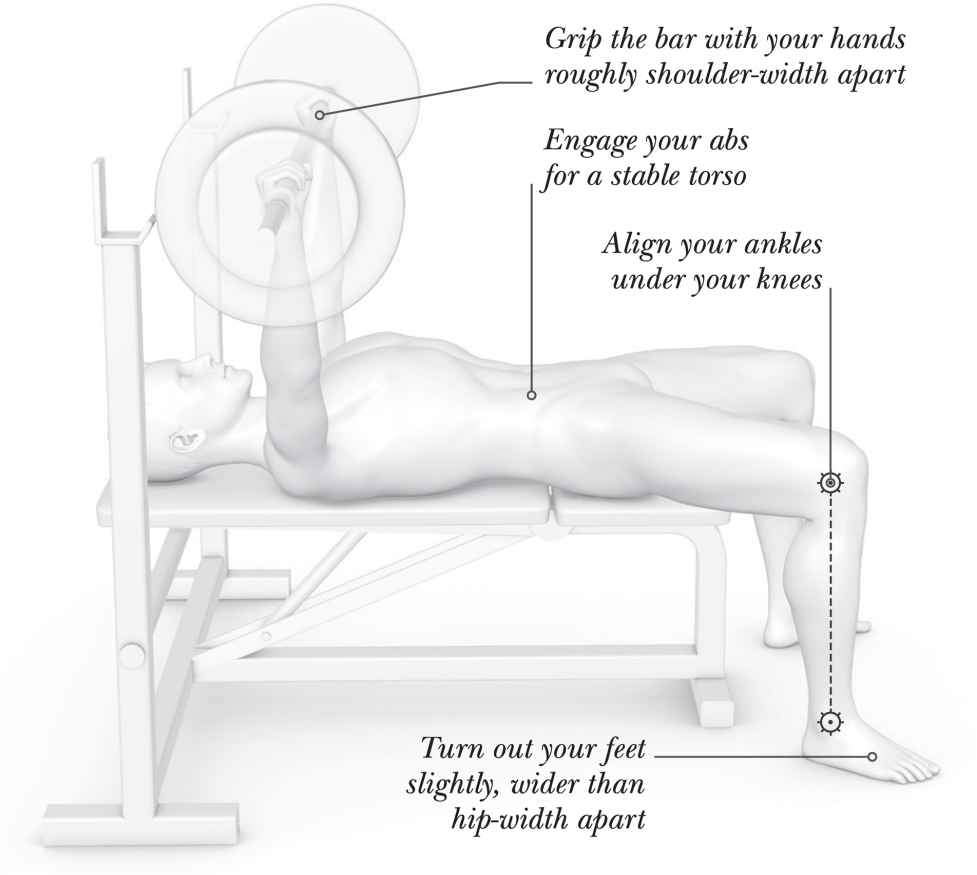
THE BIG PICTURE

For a bench press, it's crucial to set up the rack. Position the bar rack 15–20cm (6–8in) from the barbell so you can rack it and unrack it easily. Set the rack to a height that you can easily pick up, and clear rack pins as you get into position.

Beginners can start with 4 sets of 8–10 reps; discover other variations of this exercise and targeted sets in the training programmes.

PREPARATORY STAGE

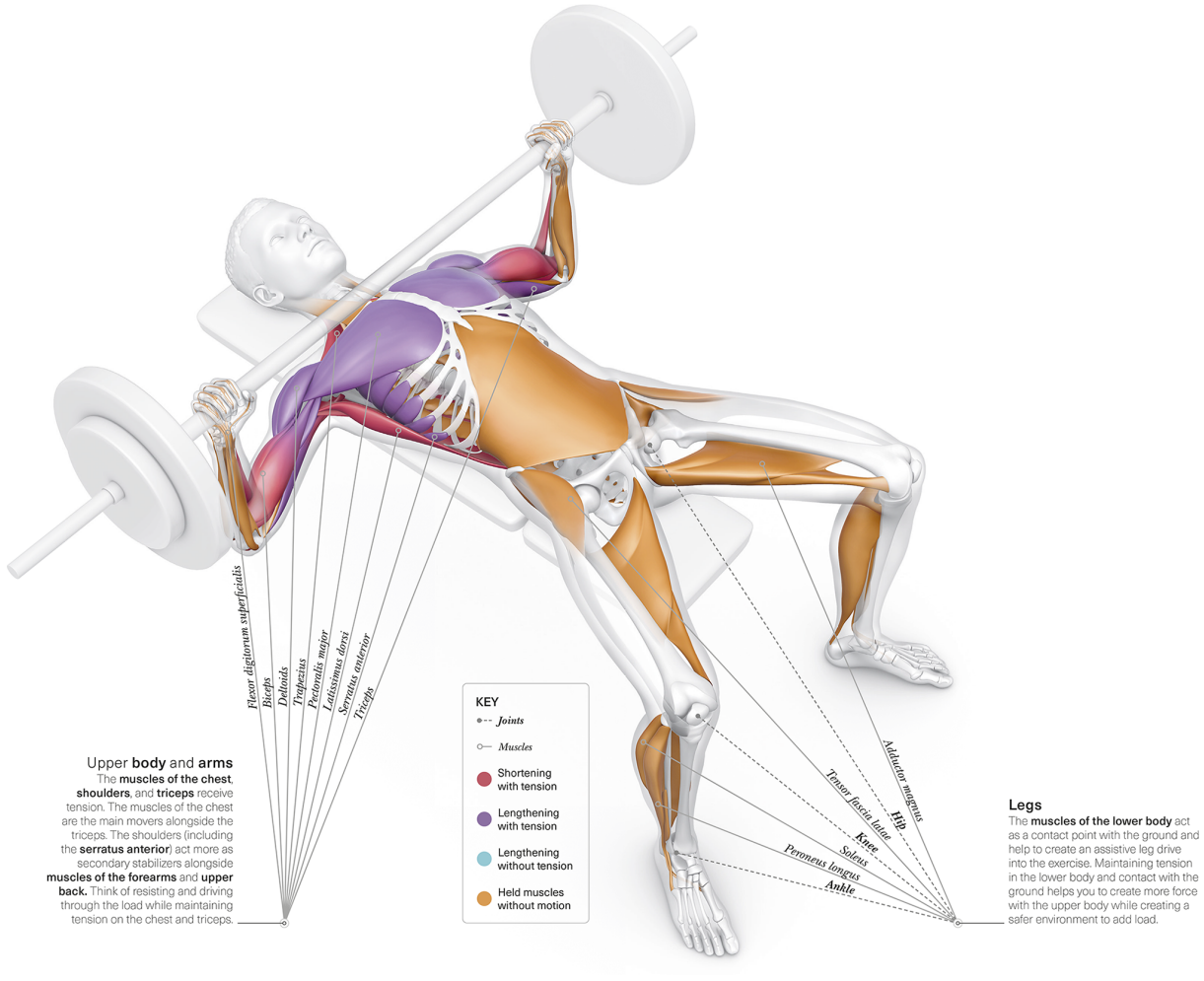
Having set up the rack, lie flat with your buttocks fully on the bench and your feet flat on the floor. Grip the barbell with an overhand standard grip and lift it straight up. Keep your head in a neutral position throughout.



Double-tap image to read the labels

STAGE ONE

Take a breath in and engage your abs to help stabilize your core and hold. Activate muscles of the upper back and start to bend at the elbow, resisting the load as it moves toward your chest. The bar travels from mid-chest to lower sternum and can touch your chest or stop just shy of it.



ℹ Double-tap image to read the labels

SUPERIOR-ANTERIOR-LATERAL VIEW

Upper **body** and **arms**

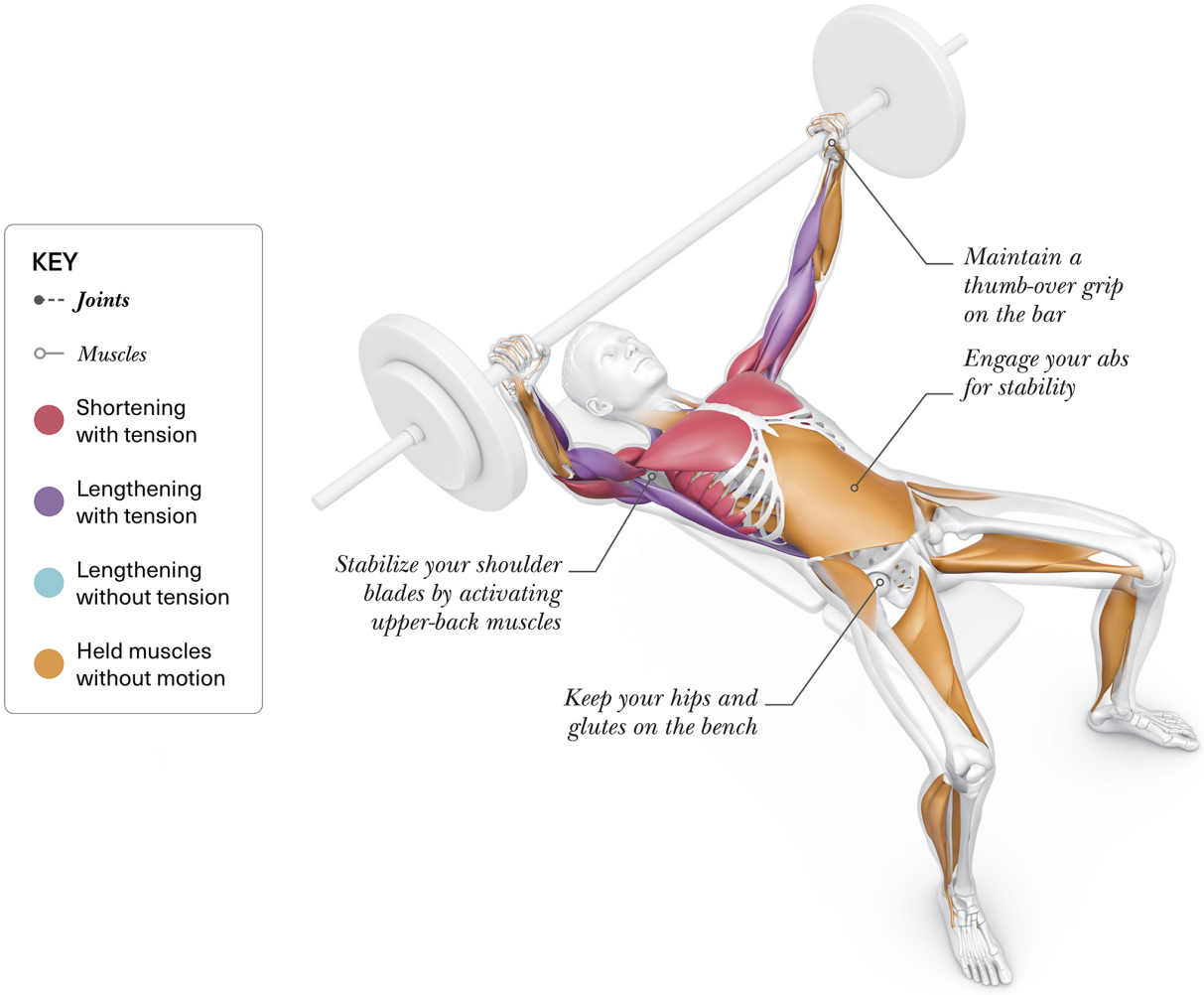
The **muscles of the chest**, **shoulders**, and **triceps** receive tension. The muscles of the chest are the main movers alongside the triceps. The shoulders (including the **serratus anterior**) act more as secondary stabilizers alongside **muscles of the forearms** and **upper back.** Think of resisting and driving through the load while maintaining tension on the chest and triceps.

Legs

The **muscles of the lower body** act as a contact point with the ground and help to create an assistive leg drive into the exercise. Maintaining tension in the lower body and contact with the ground helps you to create more force with the upper body while creating a safer environment to add load.

STAGE TWO

Keep your abs engaged and place tension through your chest and triceps to extend at the elbow. Move the bar away from your chest toward the starting position, breathing out as you do so. Hold the top position for 1 second to reset your breathing then repeat stages 1 and 2.



Double-tap image to read the labels

Common mistakes

Take care not to flare your elbows too high by matching the bar path. And don't let the bar bounce off your chest at the bottom of the movement.

VARIATIONS

Bench presses are popular strength-training exercises because they train so many muscles (pecs, delts, and triceps) at the same time; in fact, a bench press is a full-body workout as the core, back, and legs are also engaged to support the work of the muscles of the upper body and arms. Building muscle strength in the upper body can be useful for certain sports, such as sprinting, football, and tennis.

CLOSE-GRIP BARBELL BENCH PRESS

While essentially similar to the wide-grip barbell bench press on the previous pages, shifting the grip inward means this variation is a more dominant triceps exercise. If you experience any joint discomfort during this exercise, try switching to the dumbbell version.

PREPARATORY STAGE

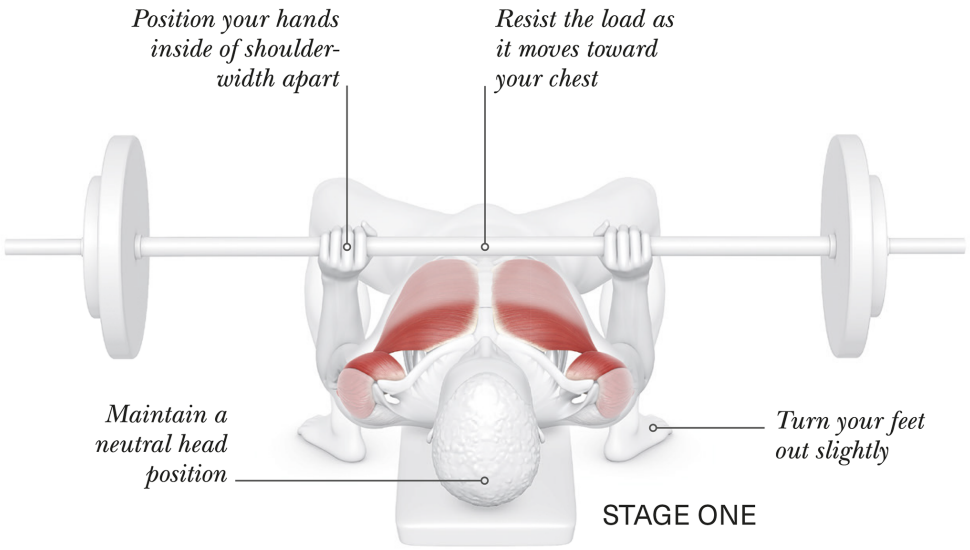
Set yourself up on the bench as on Barbell Bench Press. Grip the barbell with an overhand grip that's inside shoulder-width. Then, lift it level with your eyes.

STAGE ONE

Breathe in and engage your abs before flexing at the elbow and controlling the descent of the bar toward your chest; it might touch or stop just shy of it.

STAGE TWO

As you exhale, place tension through your chest and triceps to extend at the elbow, moving the bar up to the starting position. Repeat stages 1 and 2.



Double-tap image to read the labels

INCLINE BARBELL BENCH PRESS

This seated variation of the bench press offers a similar movement, but the more upright position used here targets more of the middle and upper chest, while also training the muscles of the shoulders and the triceps. Set the angle of the bench to about 45°.

PREPARATORY STAGE

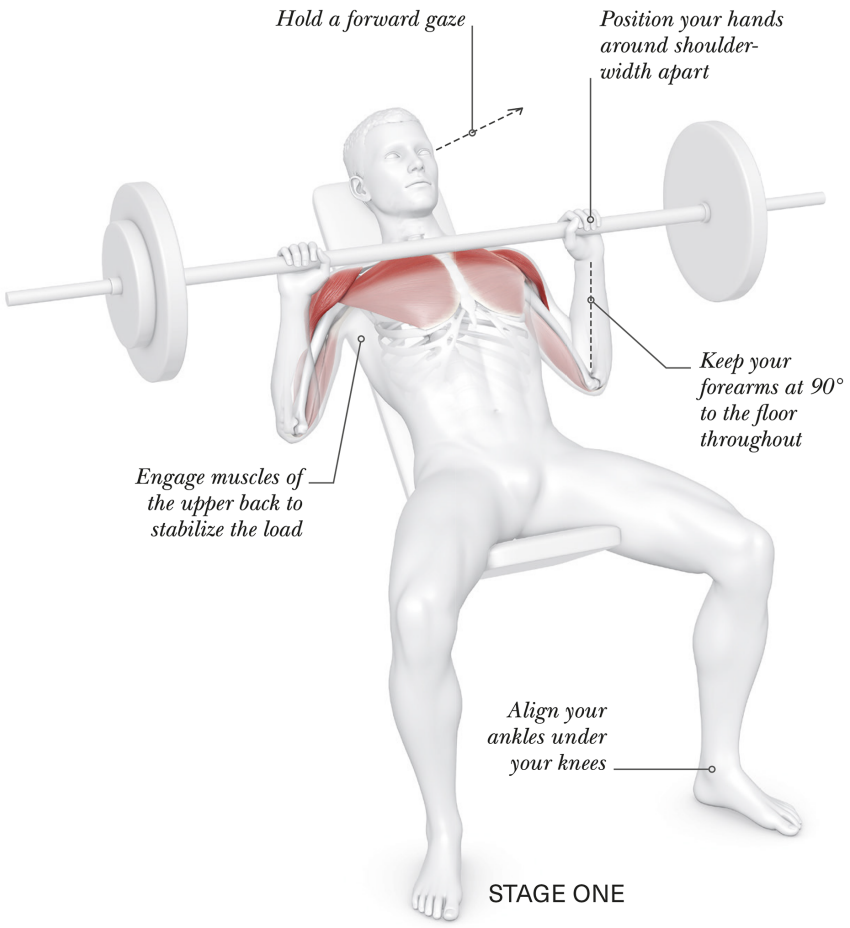
Sit on the bench with your back on the back pad and with the barbell across your lap. Lift the barbell above your head so your arms are at 90° to the floor.

STAGE ONE

Breathe in and engage your abs and upper-back muscles while bending your arms at the elbow and resisting the load as it moves toward your chest.

STAGE TWO

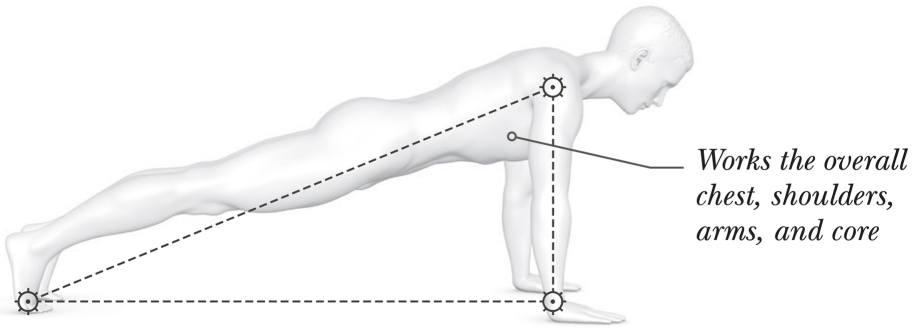
Place tension through your chest and triceps to extend at the elbow, lifting the bar up to the starting position while breathing out. Repeat stages 1 and 2.



Double-tap image to read the labels

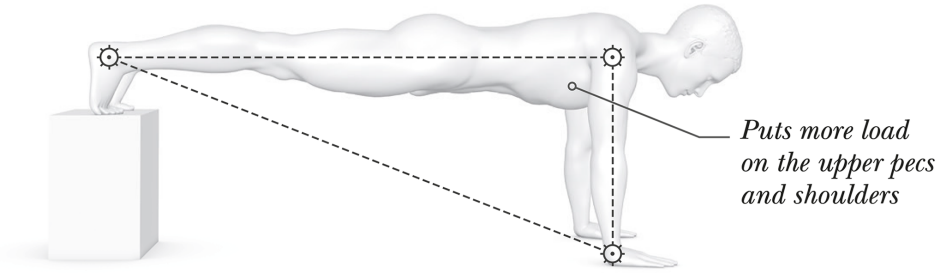
Working **intensity**

Push-ups are a great overall bodyweight pressing variation. A regular push-up, where you place your feet on the floor, allows you to press 64 per cent of your bodyweight; but if you elevate your feet on a 30cm (12in) box or bench, the weight you are working with rises to 70 per cent of your bodyweight. So, elevating your feet is a simple but effective progression if you want extra challenge.



Double-tap image to read the labels

REGULAR PUSH-UP



Double-tap image to read the labels

DECLINE PUSH-UP

PUSH-UP

This variation uses the same pressing movement as the barbell bench press (and so challenges the same muscles) but completes it with bodyweight and in a prone position. It's a "do anytime, anywhere" exercise.

PREPARATORY STAGE

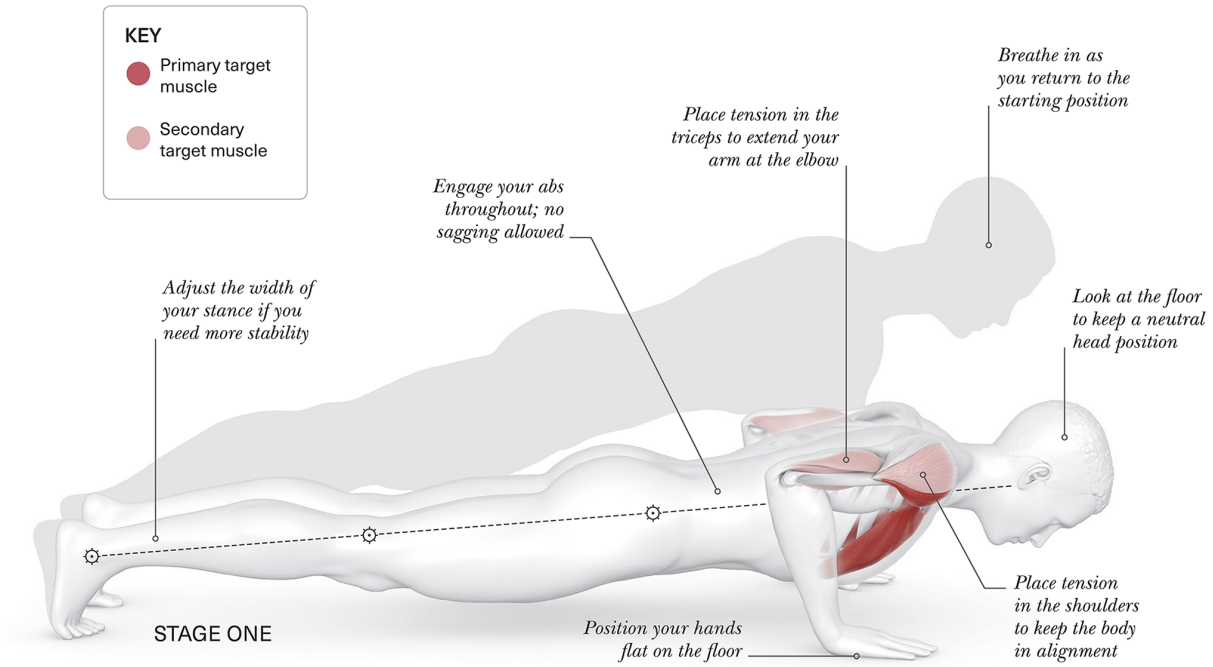
Lie face down on the floor with your feet hip-width apart and your hands just outside of shoulder-width apart. Hold your body as one off the floor slightly.

STAGE ONE

Take a breath in and engage your abs and upper-back muscles. Extend your arms at the elbow, raising your chest and body off the floor while breathing out.

STAGE TWO

Breathe in as you return to the starting position, while controlling the descent and keeping your body in alignment throughout. Repeat stages 1 and 2.



Double-tap image to read the labels

DUMBBELL BENCH PRESS

This exercise trains the chest, triceps, and shoulders. Using dumbbells rather than a barbell allows for a more natural and slightly lower arm position – and, consequently, an increased range of motion and greater degree of shoulder extension.

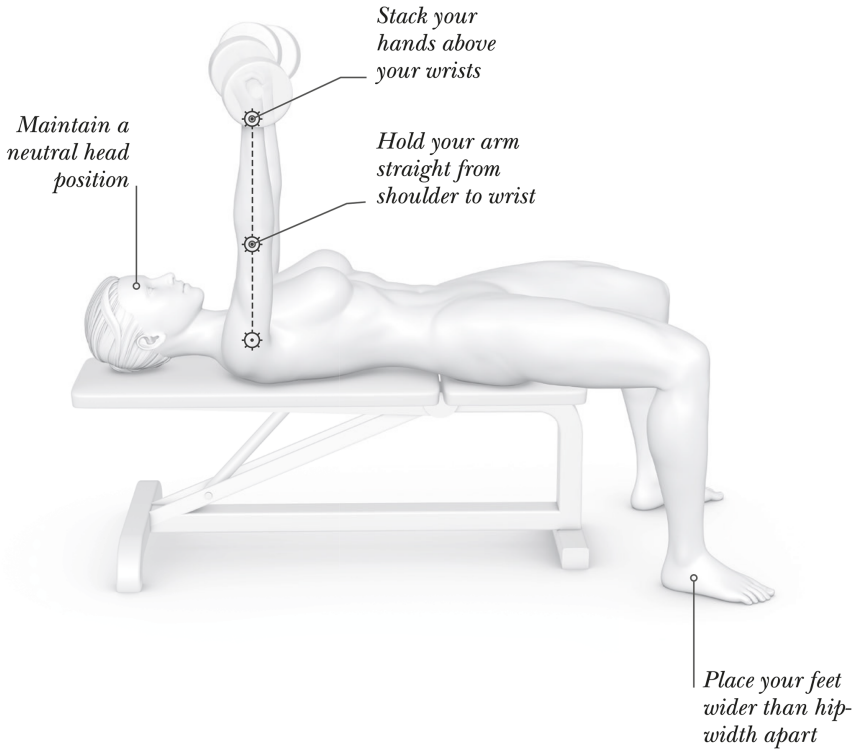
THE BIG PICTURE

This move uses the same lying-on-a-bench position as in the barbell bench press. Since the weights are above you, use an overhand grip with thumbs over fingers. Your body and legs stay still and strong while you lower and lift the load.

Beginners can start with 4 sets of 8–10 reps; discover other variations and other targeted sets in the training programmes.

PREPARATORY STAGE

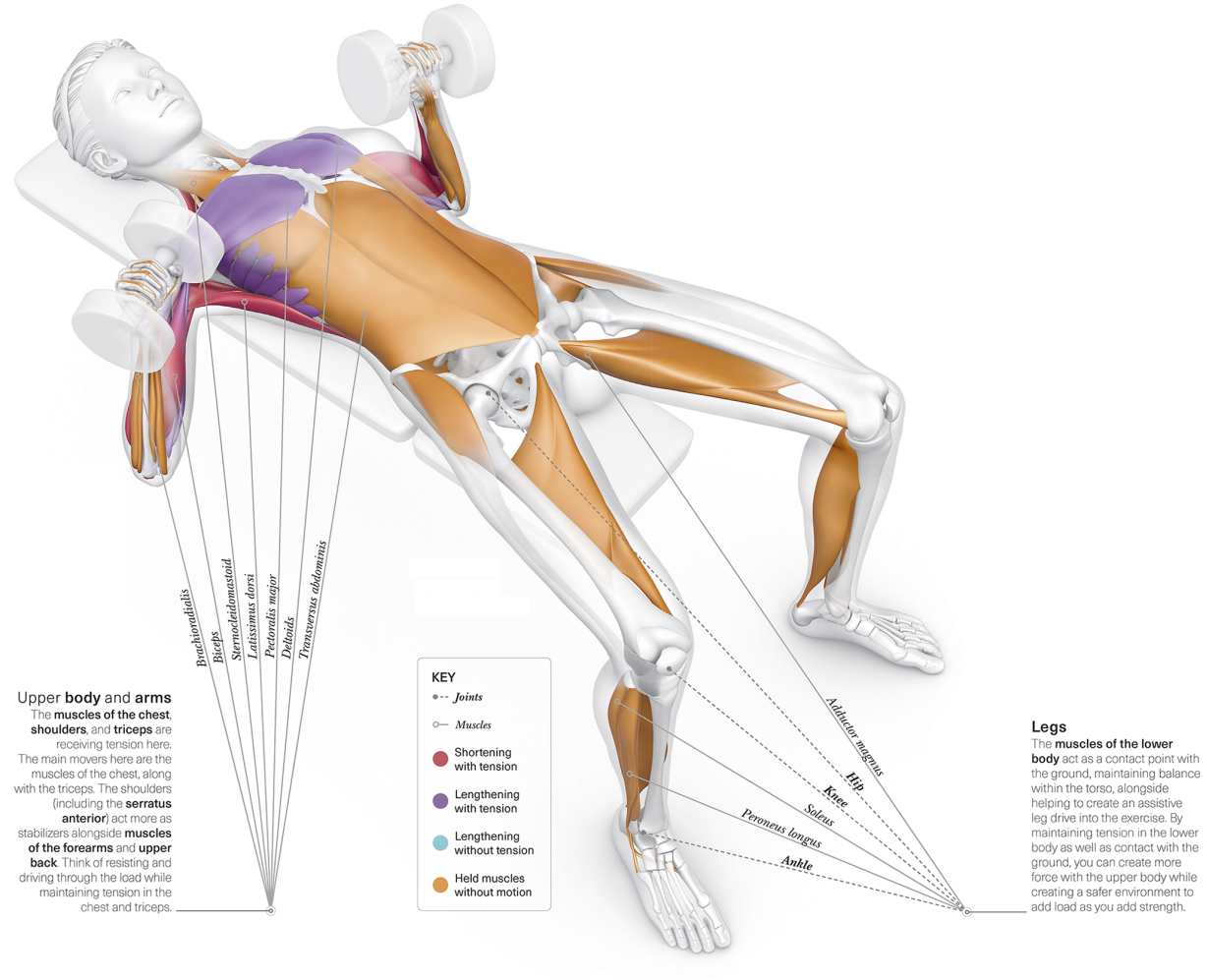
Lie flat with your buttocks fully on the bench and your feet flat on the floor. Hold the dumbbells with an overhand grip, resting them on your legs. Then lift the weights directly above your shoulders so your wrists align with your upper arms.



Double-tap image to read the labels

STAGE ONE

Take a breath in, engage your abs, and activate the muscles of your upper back for stability. Bend at the elbows, resisting the load as it moves toward your chest; the dumbbells can touch your chest or stop just shy of it. To add challenge, pause for 1–2 seconds here, keeping tension in the chest.



Double-tap image to read the labels

SUPERIOR-ANTERIOR-LATERAL VIEW

Upper **body** and **arms**

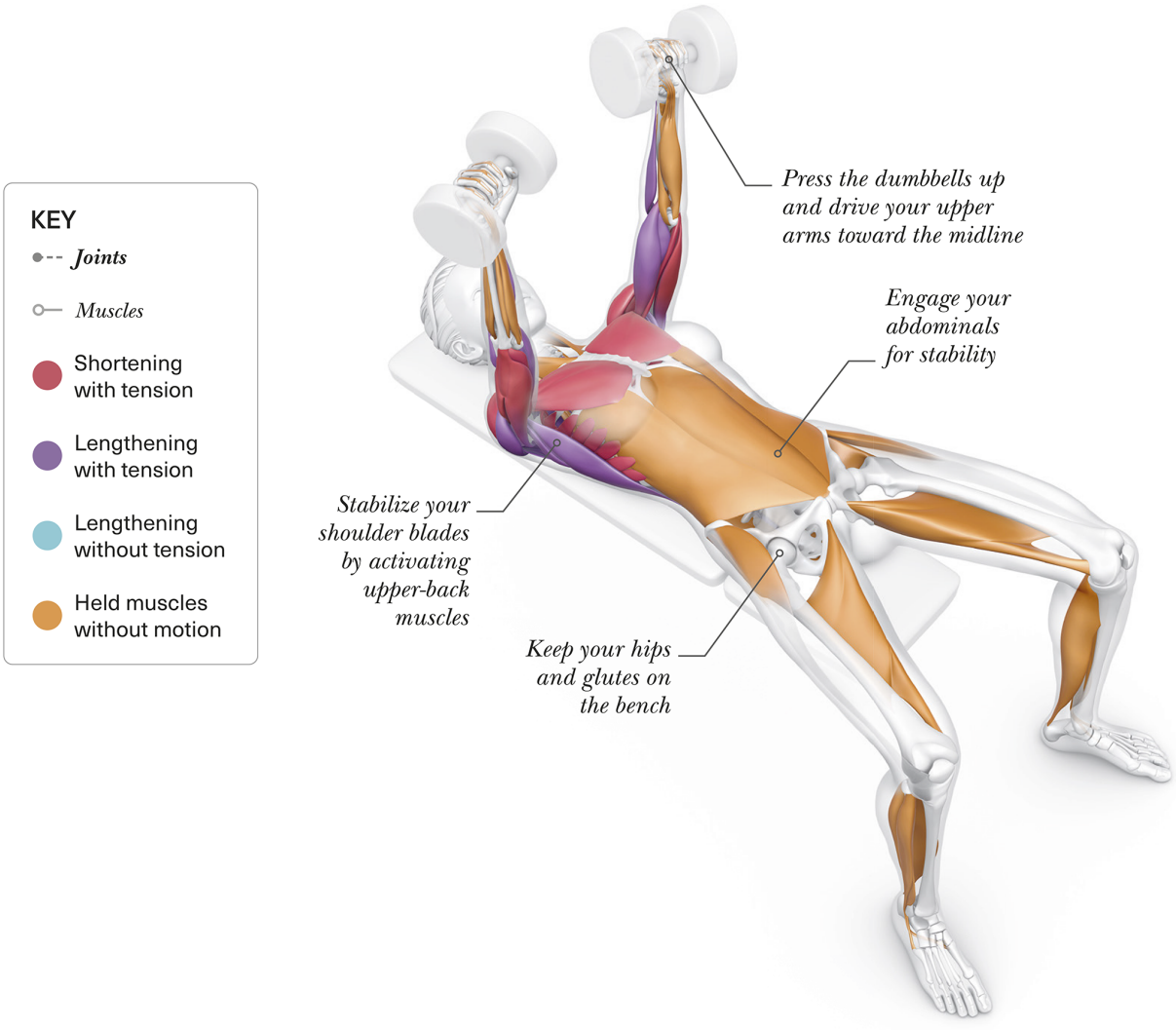
The **muscles of the chest**, **shoulders**, and **triceps** are receiving tension here. The main movers here are the muscles of the chest, along with the triceps. The shoulders (including the **serratus anterior**) act more as stabilizers alongside **muscles of the forearms** and **upper back**. Think of resisting and driving through the load while maintaining tension in the chest and triceps.

Legs

The **muscles of the lower body** act as a contact point with the ground, maintaining balance within the torso, alongside helping to create an assistive leg drive into the exercise. By maintaining tension in the lower body as well as contact with the ground, you can create more force with the upper body while creating a safer environment to add load as you add strength.

STAGE TWO

With abs engaged, breathe out, placing tension in your chest and triceps to extend at the elbows and lift the dumbbells back up. As you drive up, think of driving your upper arms across your chest. Hold the top position for 1 second to reset your breathing. Repeat stages 1 and 2.



Double-tap image to read the labels

Common mistakes

It is easy to strain the shoulder or elbow joint during this exercise – strengthening your chest and using an appropriate arm path will help you to avoid this.

VARIATIONS

There's a variation for all situations here with a lying, seated, and standing version of the dumbbell bench press. If you are new to the exercise, you may find it helpful to practise the movement of a bench press while standing, or with each arm individually.

UNILATERAL DUMBBELL BENCH PRESS

This lying variation targets the chest, shoulders, and triceps. But performing the movement one arm at a time also challenges your core and hip stability as well as adding variety to your pressing options. Be sure to work each arm evenly; alternate each time or do reps on one side and swap.

PREPARATORY STAGE

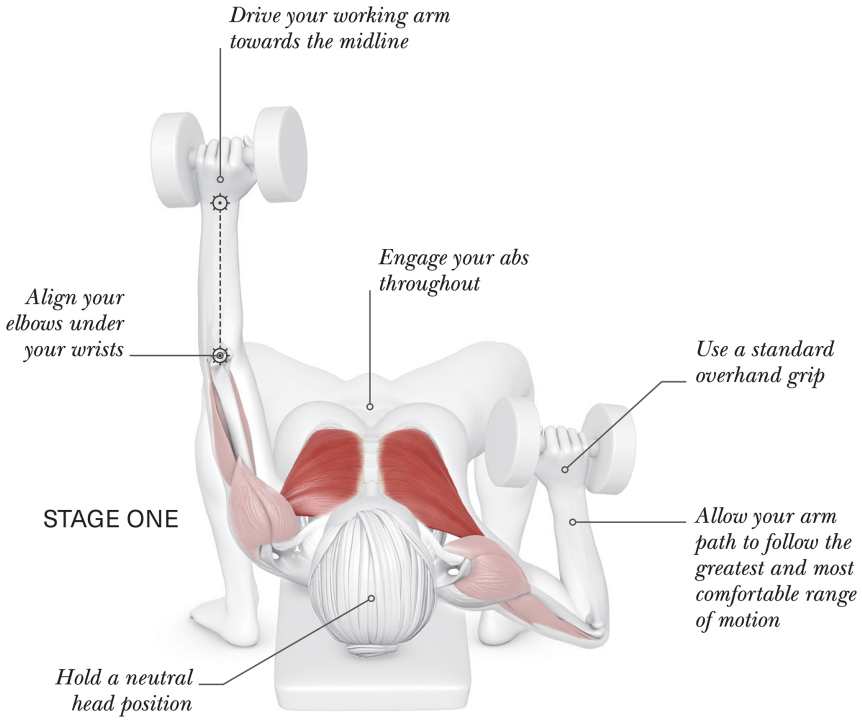
Set yourself up on the bench as on Dumbbell Bench Press. Hold the dumbbells with a standard overhand grip. Drive your upper arms toward the midline to lift the load.

STAGE ONE

Take a breath in, engage your abs, and activate your upper-back muscles. Bend at the elbow of your working arm to resist the load as it descends.

STAGE TWO

With abs engaged and tension in your triceps and chest, extend your working arm to press the weight away as you breathe out. Repeat stages 1 and 2.



Double-tap image to read the labels

INCLINE DUMBBELL BENCH PRESS

This seated variation is related to the incline barbell bench press but has the versatility of using a more individualized arm path, with the freedom that a dumbbell offers over a barbell. You'll also work more of the upper and middle chest, along with the shoulders and triceps.

PREPARATORY STAGE

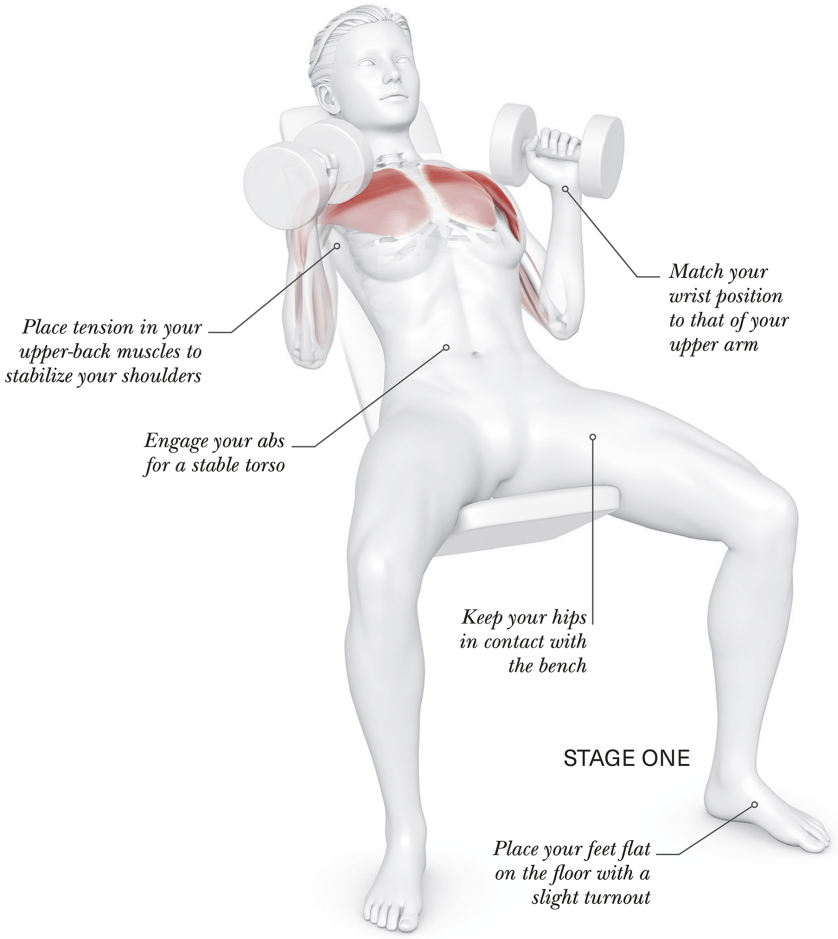
Set yourself up as on Dumbbell Bench Press but with the dumbbells in your lap. Using a standard overhand grip, press the dumbbells up and toward the midline.

STAGE ONE

Take a breath in, engage your abs, and activate your upper-back muscles. Bend at the elbows and resist the load as it moves toward your chest.

STAGE TWO

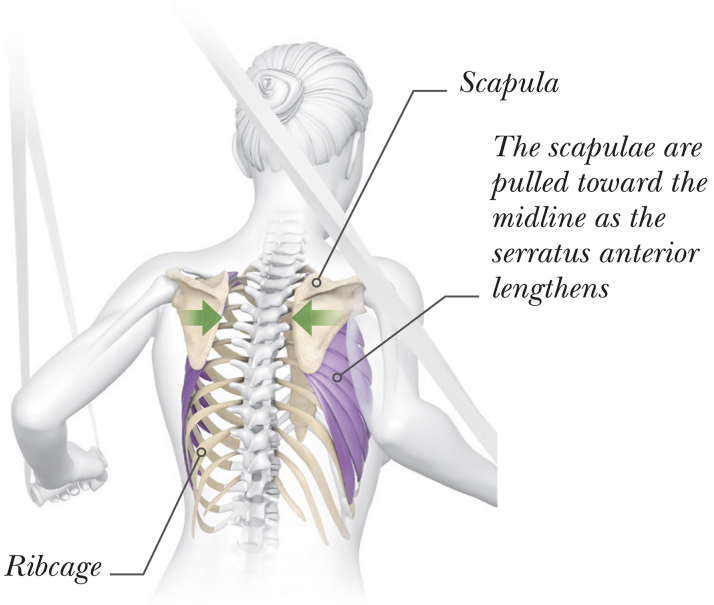
With abs engaged and tension in your triceps and your chest, extend your arm to press the weight away, breathing out as you do so. Repeat stages 1 and 2.



Double-tap image to read the labels

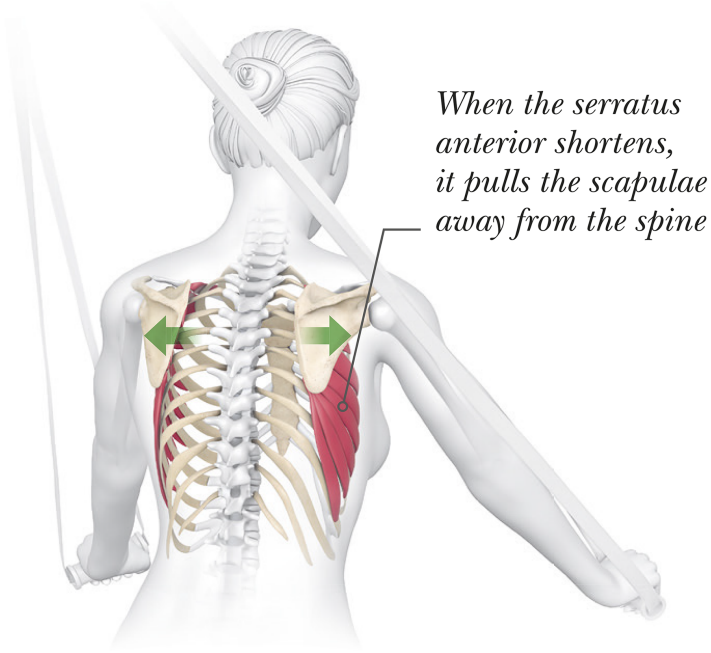
The role of the **serratus anterior**

Often known as the “boxer’s muscle” because it relates to the reaching and punching movement, the serratus anterior is a deep, fan-shaped muscle that sits under the scapula and wraps around the ribcage. It anchors the scapula so is key in the protraction of the scapula and the lifting of the ribcage. The serratus anterior also plays a vital role in stabilizing the shoulder during overhead pressing movements.



Double-tap image to read the labels

SHOULDER RETRACTION



Double-tap image to read the labels

SHOULDER PROTRACTION

BANDED CHEST PRESS

This standing variation allows you to train the movement of the pressing pattern. Your intent should be to drive your arms back out away from the midline by using your upper-back muscles to help pull your arm back, all the while keeping tension in your chest.

PREPARATORY STAGE

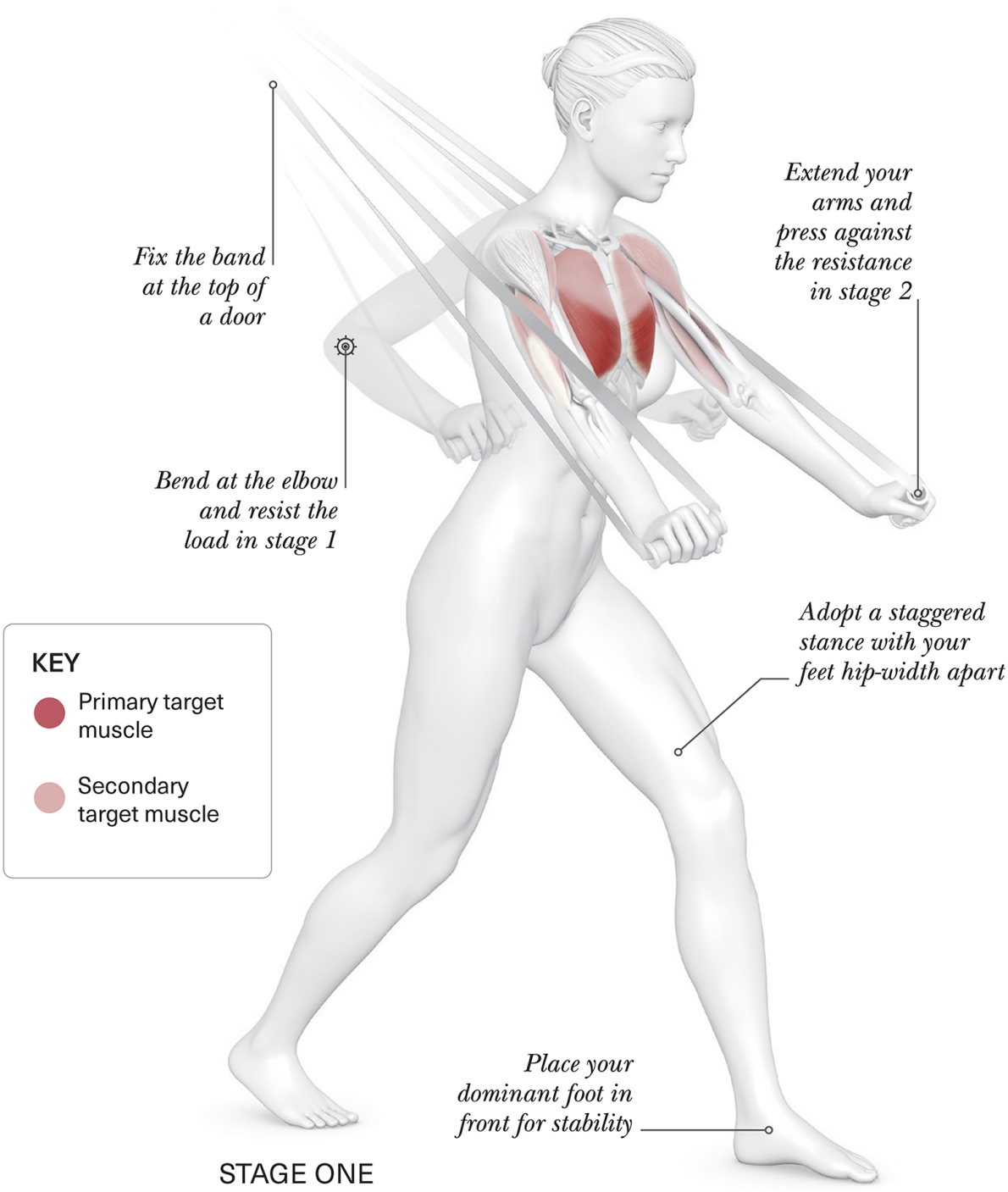
Choose an appropriate resistance band and anchor high up. Adopt a staggered stance with the band in your hands and your elbows flexed.

STAGE ONE

Take a breath in and engage your abs. Activate your upper-back muscles to pull your arms back, bending at the elbows, and resisting the band.

STAGE TWO

Place tension in your triceps and chest, and then extend your arm to press away toward the midline, breathing out as you do so. Repeat stages 1 and 2.



Double-tap image to read the labels

HIGH–LOW CABLE **CHEST FLY**

This exercise uses a high-to-low flying movement to strengthen the muscles of the chest and the shoulders, particularly the serratus anterior and pectoralis minor. The cable machine offers you the freedom to follow your own arm path.

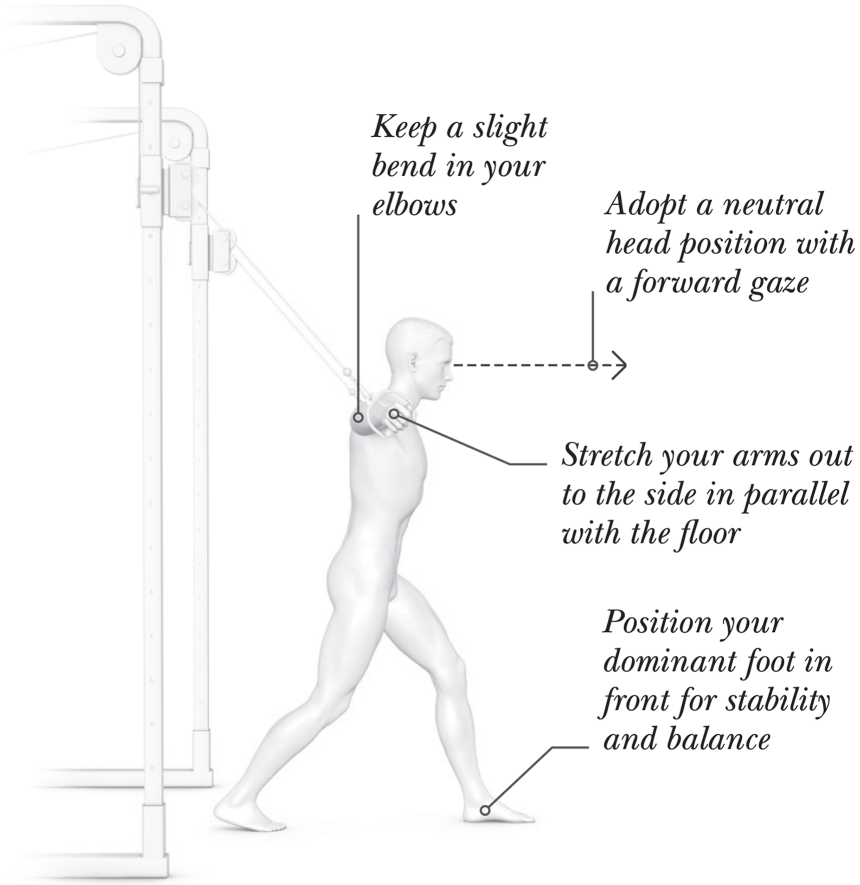
THE **BIG PICTURE**

This movement works the lower division of the pecs, so set the cable high. If you experience joint discomfort, try adjusting the setting; the path of the cable should match your arm path.

Beginners can start with 4 sets of 8–10 reps; discover variations and other targeted sets in the training programmes.

PREPARATORY STAGE

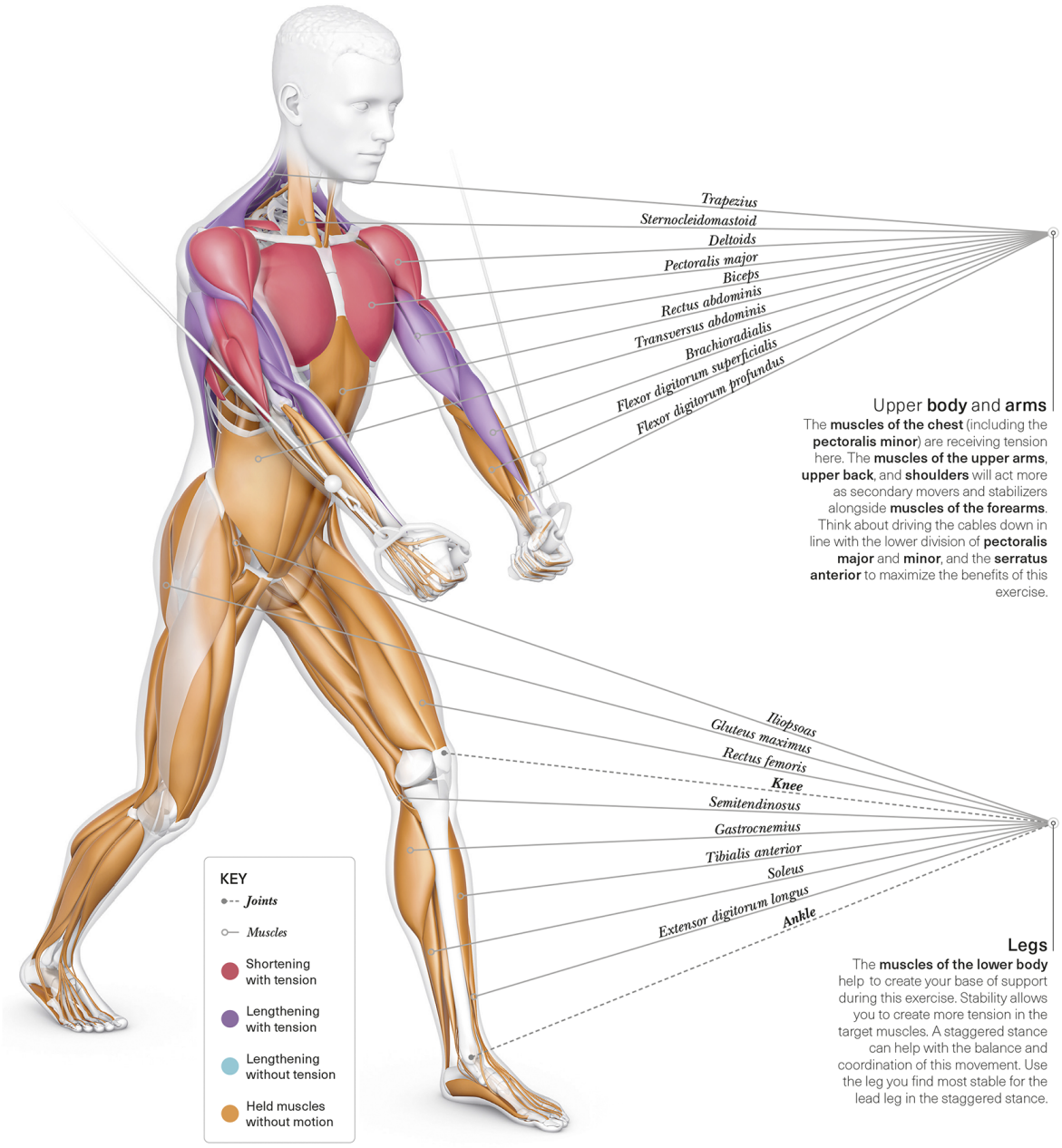
Set the weights and cable height. Grasp the handles (if you have shoulder discomfort, grab one handle at a time), then adopt a staggered stance, facing away at the middle of the machine, with your hips square. Engage your core.



Double-tap image to read the labels

STAGE ONE

Breathe in and activate the muscles of your upper back. Breathe out as you engage your chest and shoulder muscles to drive your upper arms smoothly toward the midline; your arms will naturally straighten. Hold for 1 second.



Double-tap image to read the labels

ANTERIOR-LATERAL VIEW

Upper **body** and **arms**

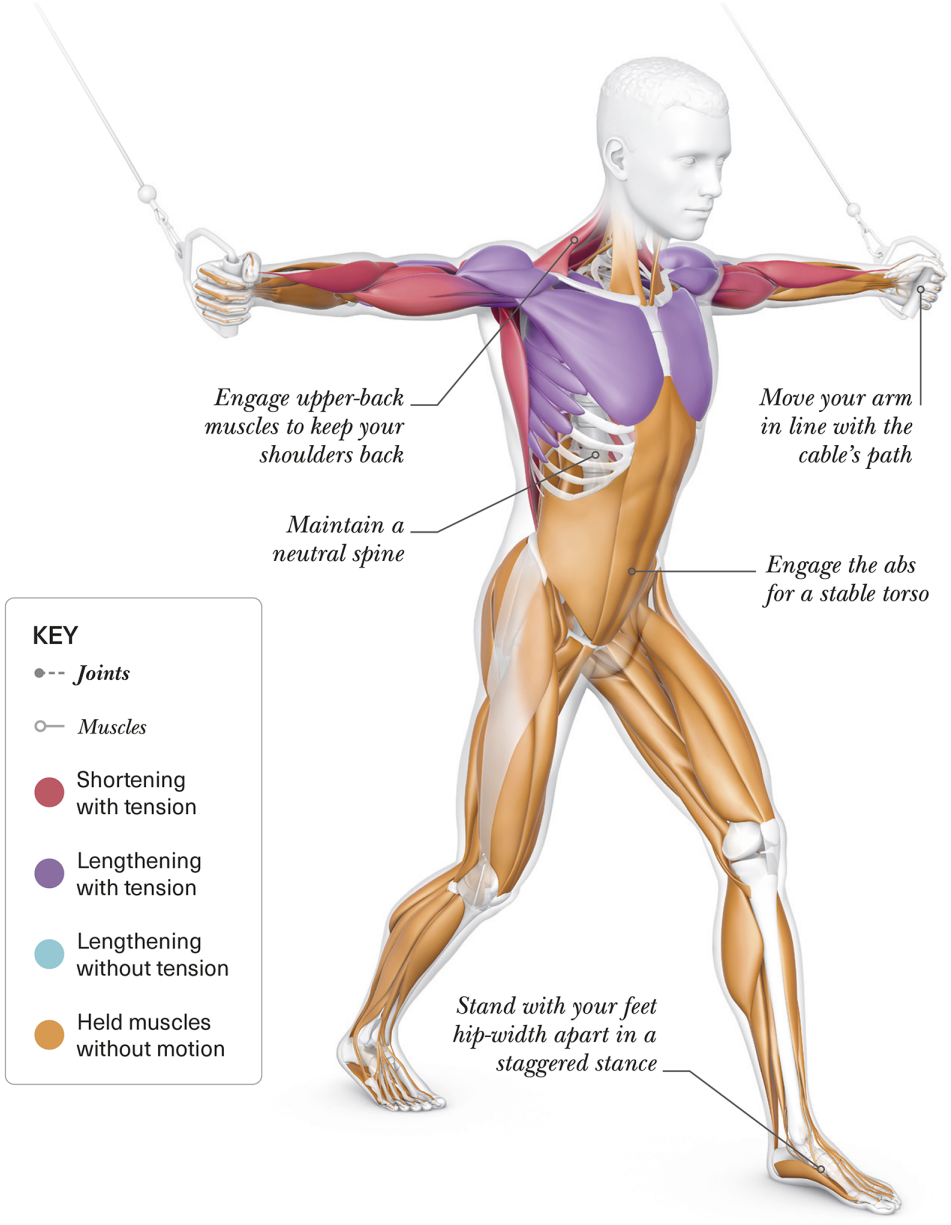
The **muscles of the chest** (including the **pectoralis minor**) are receiving tension here. The **muscles of the upper arms**, **upper back**, and **shoulders** will act more as secondary movers and stabilizers alongside **muscles of the forearms**. Think about driving the cables down in line with the lower division of **pectoralis major** and **minor**, and the **serratus anterior** to maximize the benefits of this exercise.

Legs

The **muscles of the lower body** help to create your base of support during this exercise. Stability allows you to create more tension in the target muscles. A staggered stance can help with the balance and coordination of this movement. Use the leg you find most stable for the lead leg in the staggered stance.

STAGE TWO

Breathe in and engage your abs. As you exhale, engage your upper back and fly your arms back out horizontally; keep tension in the chest and let your elbows bend. Hold for 1 second, reset your breathing, and repeat stages 1 and 2.



ℹ Double-tap image to read the labels

Common mistakes

In any cable fly exercise, misalignment between your arm path and the line of resistance formed by the cable can cause you to strain your shoulder. Adjusting the height of the cables to bring the line of resistance into better alignment for your structure and arm path will help you to avoid injury.

VARIATIONS

Varying the starting and end positions of the cable in a chest fly allows you to target different muscle areas. A change in starting position will affect the position of the arms – which in turn directly impacts where the resistance moves across the chest, and which division of the pectoralis major is used. There is also a high-to-low option that doesn't require cables, using bands to provide resistance instead, making it ideal for at-home training.

HIGH–LOW BANDED CHEST FLY

This at-home option allows you to train the movement pattern of the fly without the need for free weights or cables; it is a more effective way to challenge the chest muscles compared with a push-up or press.

PREPARATORY STAGE

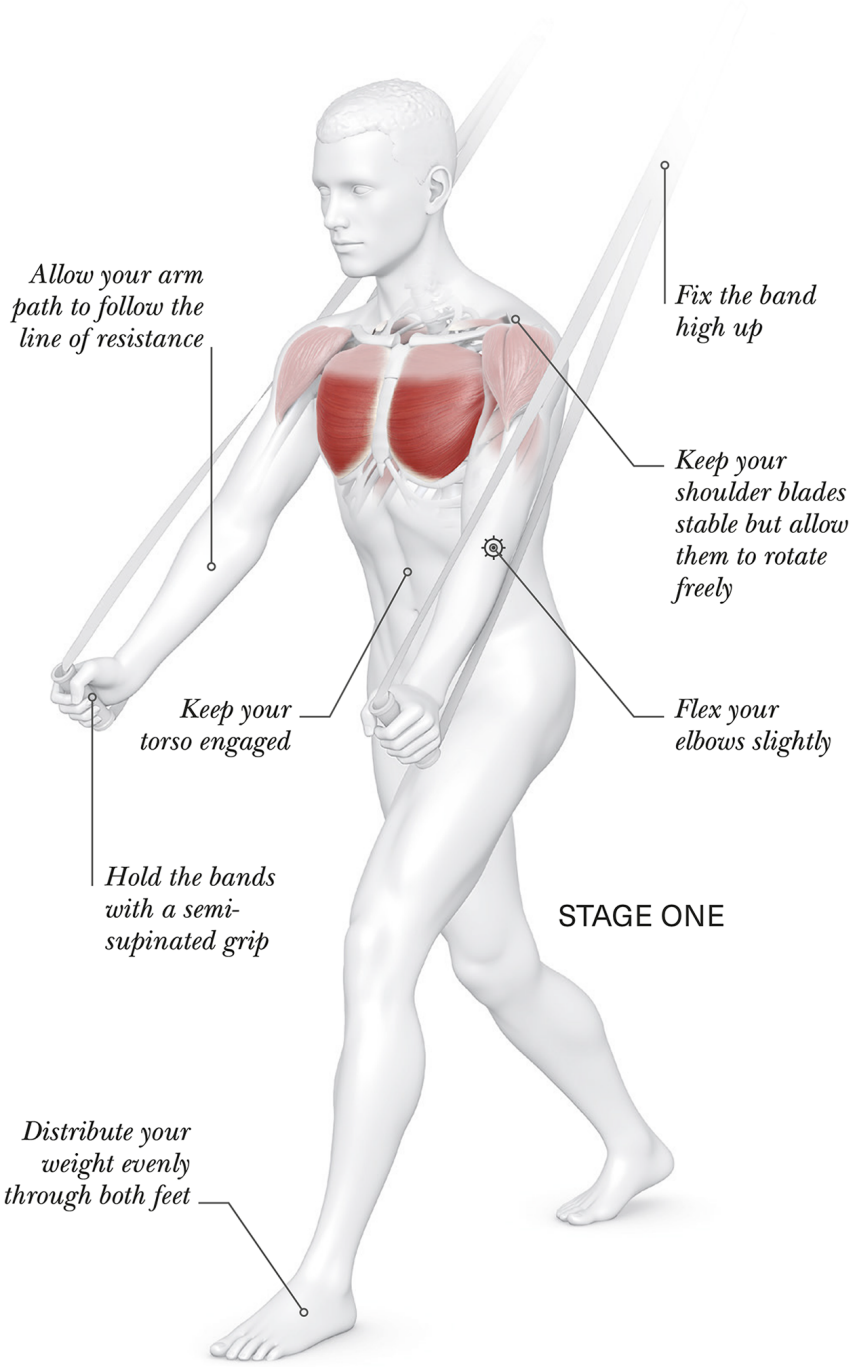
Secure two bands on top of a door or other anchor. Adopt the starting position on High-Low Cable Chest Fly, with your dominant foot forward, and hold onto the bands.

STAGE ONE

Breathe in and engage your core. Breathe out as you drive your arms down and torward the midline, following the path of the bands. Hold for 1 second.

STAGE TWO

Breathe in to engage your core, then breathe out to drive your arms back and away from the midline, using the upper-back muscles. Repeat stages 1 and 2.

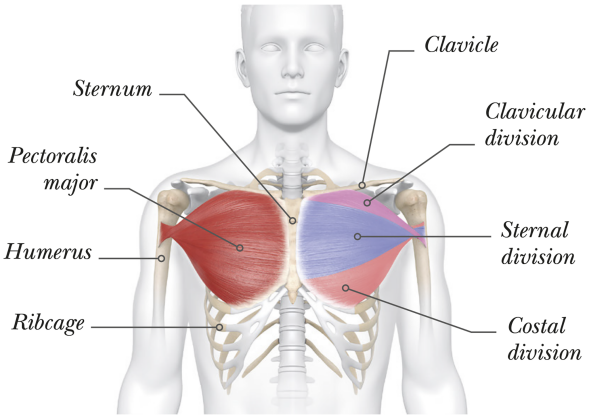


Double-tap image to read the labels

“Target chest muscles safely and effectively ***using cables****. The cable machine keeps tension on your pecs for* ***both the lifting and the lowering parts*** *of each rep.”*

The three divisions of **pectoralis major**

Pectoralis major is divided into three main divisions: costal (lower), sternal (mid), and clavicular (upper). Your arm path and the line of resistance (formed by the cable or bands you are working with) will determine which of these divisions is most challenged during a pressing or a flying movement.



Double-tap image to read the labels

MID-CABLE CHEST FLY

Keep a slight bend at the elbows during this cable exercise to reduce the strain on your biceps. Your arms should line up with the line of resistance from the cable. Avoid rounding your shoulders as you fly forward.

PREPARATORY STAGE

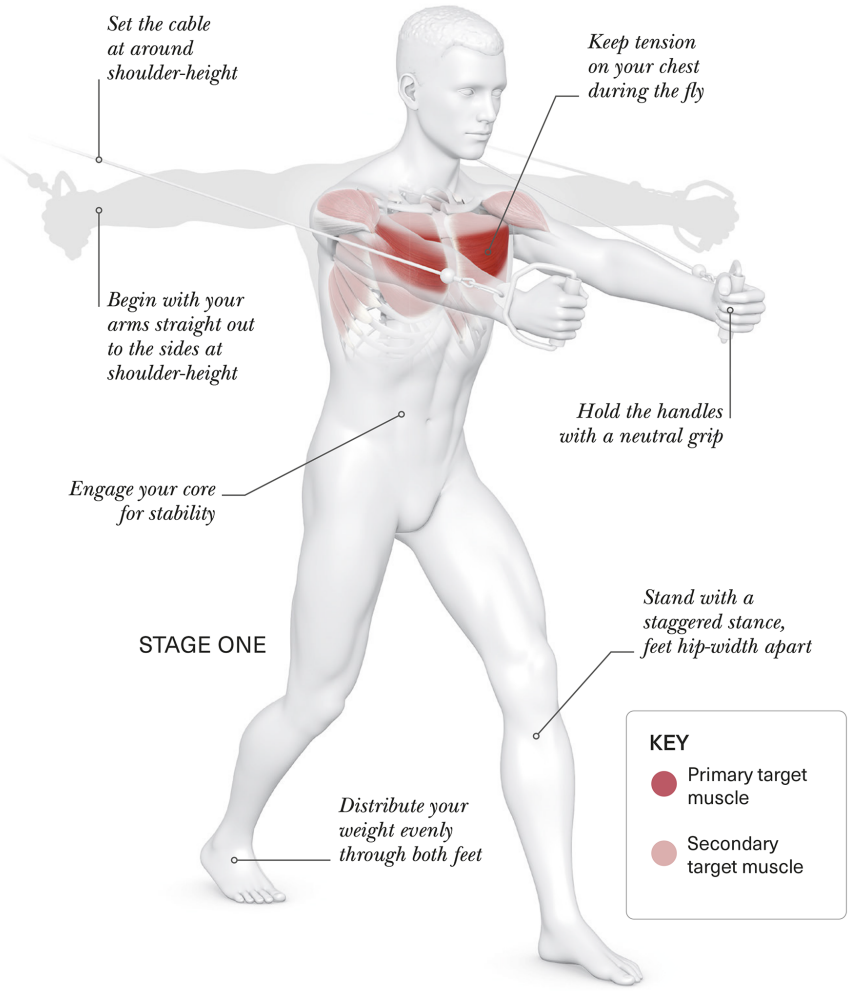
Set the cable starting position at shoulder height and adopt the starting pose used on High-Low Cable Chest Fly. Hold your arms straight out to the sides.

STAGE ONE

Breathe in to brace your core, then breathe out as you drive your arms together so they are parallel out in front of you; your arms will straighten out.

STAGE TWO

Breathe in again to engage your core, then breathe out to fly your arms back to the starting position, flexing slightly at the elbows. Repeat stages 1 and 2.



Double-tap image to read the labels

LOW–HIGH CABLE CHEST FLY

This variation targets the upper muscle fibres of the chest, while also training the front deltoids. Your shoulder blades should be stable, with tension in your upper back, but still able to rotate freely through the range of motion.

PREPARATORY STAGE

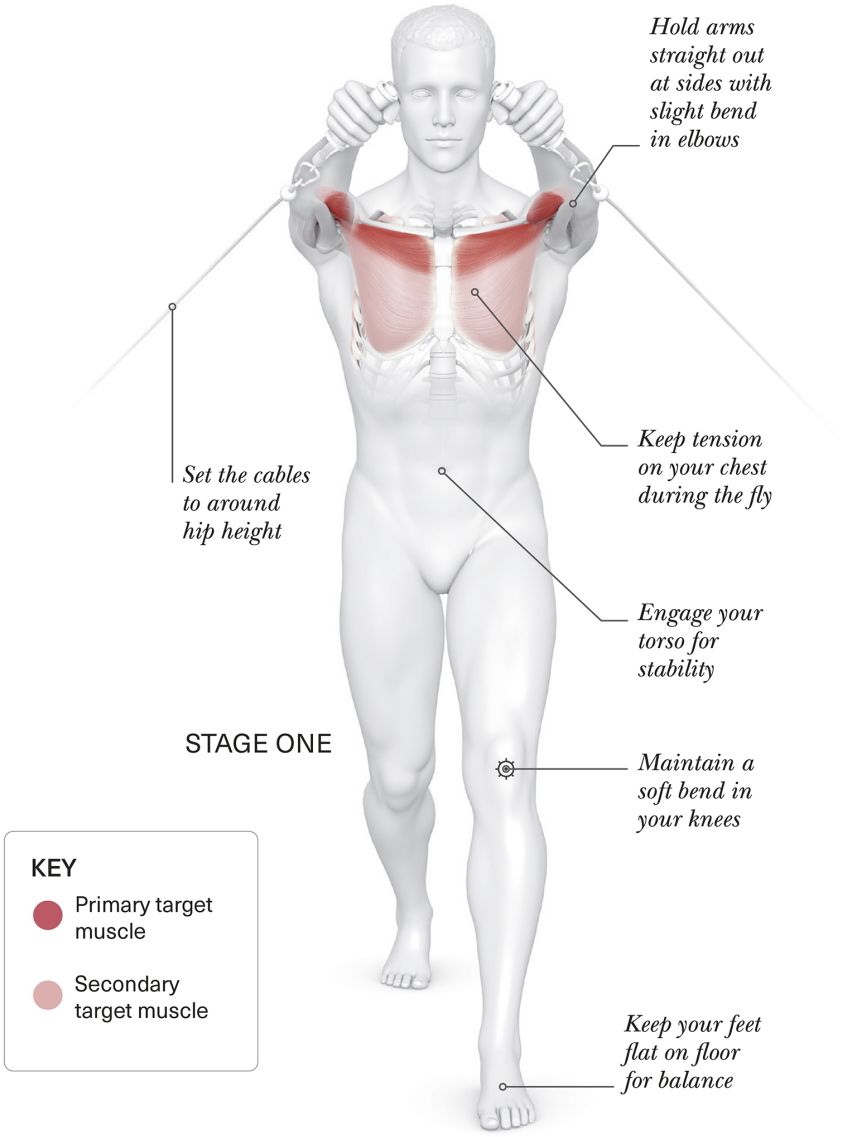
Set the cable starting position at around hip height or slightly lower, and adopt the same pose used on High-Low Cable Chest Fly, arms at your sides.

STAGE ONE

Breathe in to engage your core, then breathe out as you drive your arms up and toward the midline, using the muscles of the upper chest and front delts.

STAGE TWO

Breathe in to engage your core again, hold, then breathe out to drive your arms back out, engaging the upper-back muscles. Repeat stages 1 and 2.



Double-tap image to read the labels

MACHINE **CHEST FLY**

This exercise – also known as the pec deck – trains muscles of the chest and shoulders. Performing the movement using a machine allows you to operate within a safe and effective training environment.

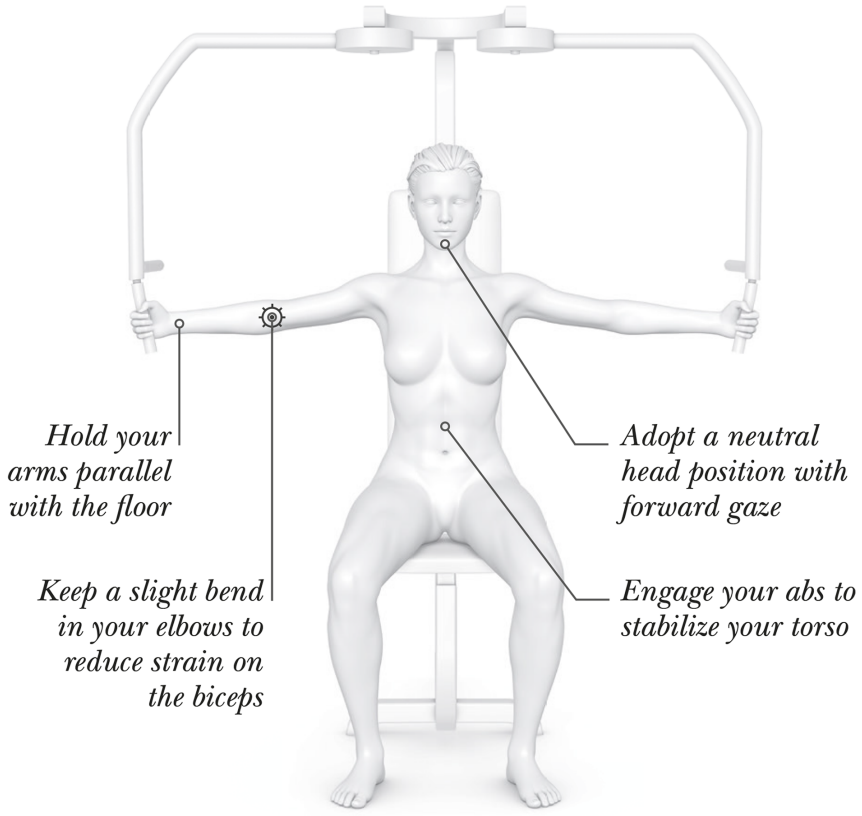
THE **BIG PICTURE**

It is important to position the seat correctly to best fit your body structure and desired arm path, to minimize any shoulder discomfort during the exercise. Your arms should be able to move easily between the midline and out wide at the sides, parallel with the floor, in a controlled flying motion.

Beginners can start with 4 sets of 8–10 reps; discover other targeted sets in the training programmes.

PREPARATORY STAGE

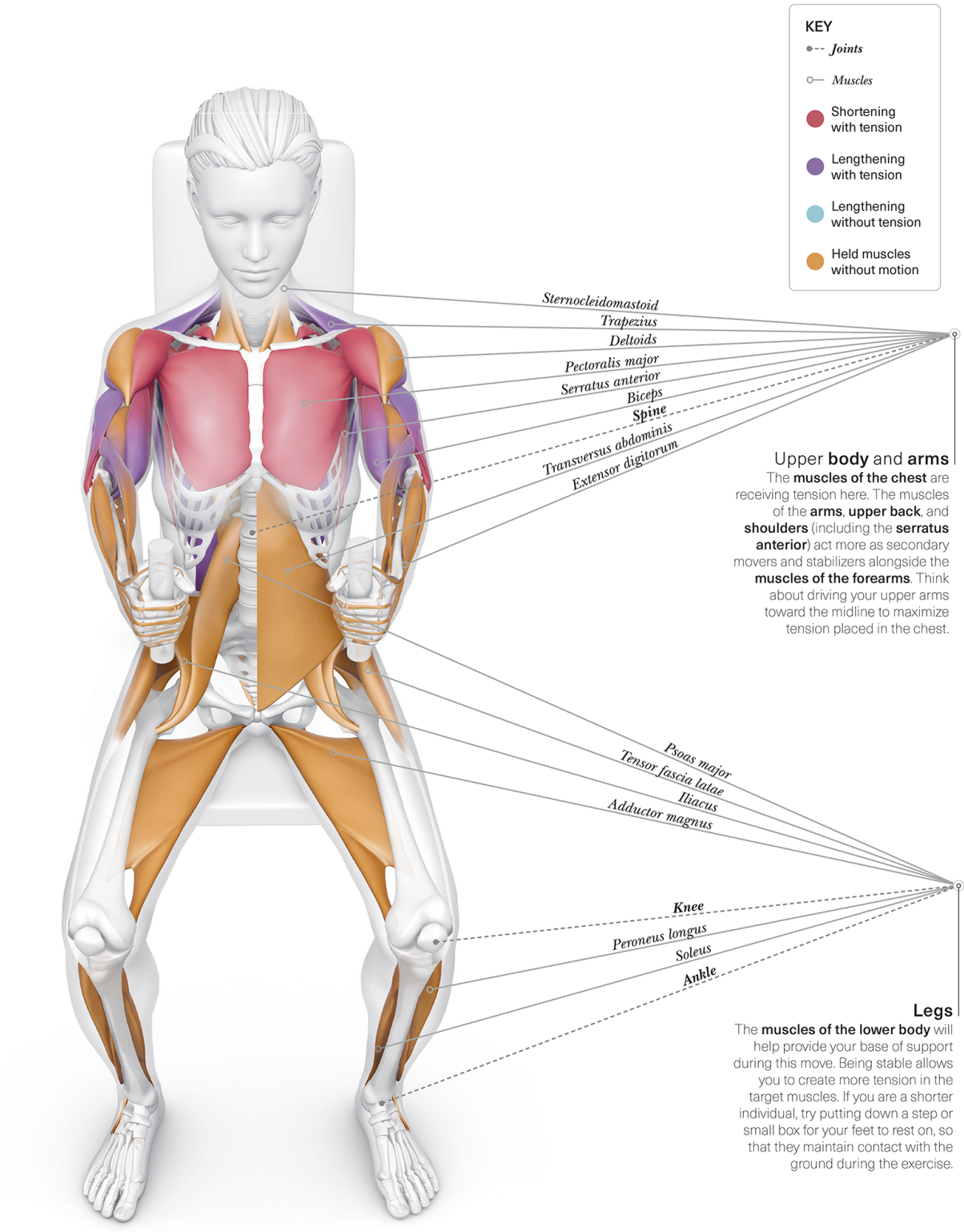
Set the weights and adjust the height of the seat. Sit down and take up a stable, comfortable stance with your feet flat on the floor and your back flat against the pad. Stretch your arms out to the sides and grasp the handles (if you have shoulder discomfort, grab one handle at a time).



ⓘ Double-tap image to read the labels

STAGE ONE

Inhale and activate your abs and upper-back muscles. Breathe out as you engage the muscles of your chest and shoulders to drive your upper arms across your chest toward your sternum; your arms will naturally straighten. To add challenge, pause for 1–2 seconds, keeping tension in the chest.



ℹ Double-tap image to read the labels

SUPERIOR-ANTERIOR VIEW

Upper **body** and **arms**

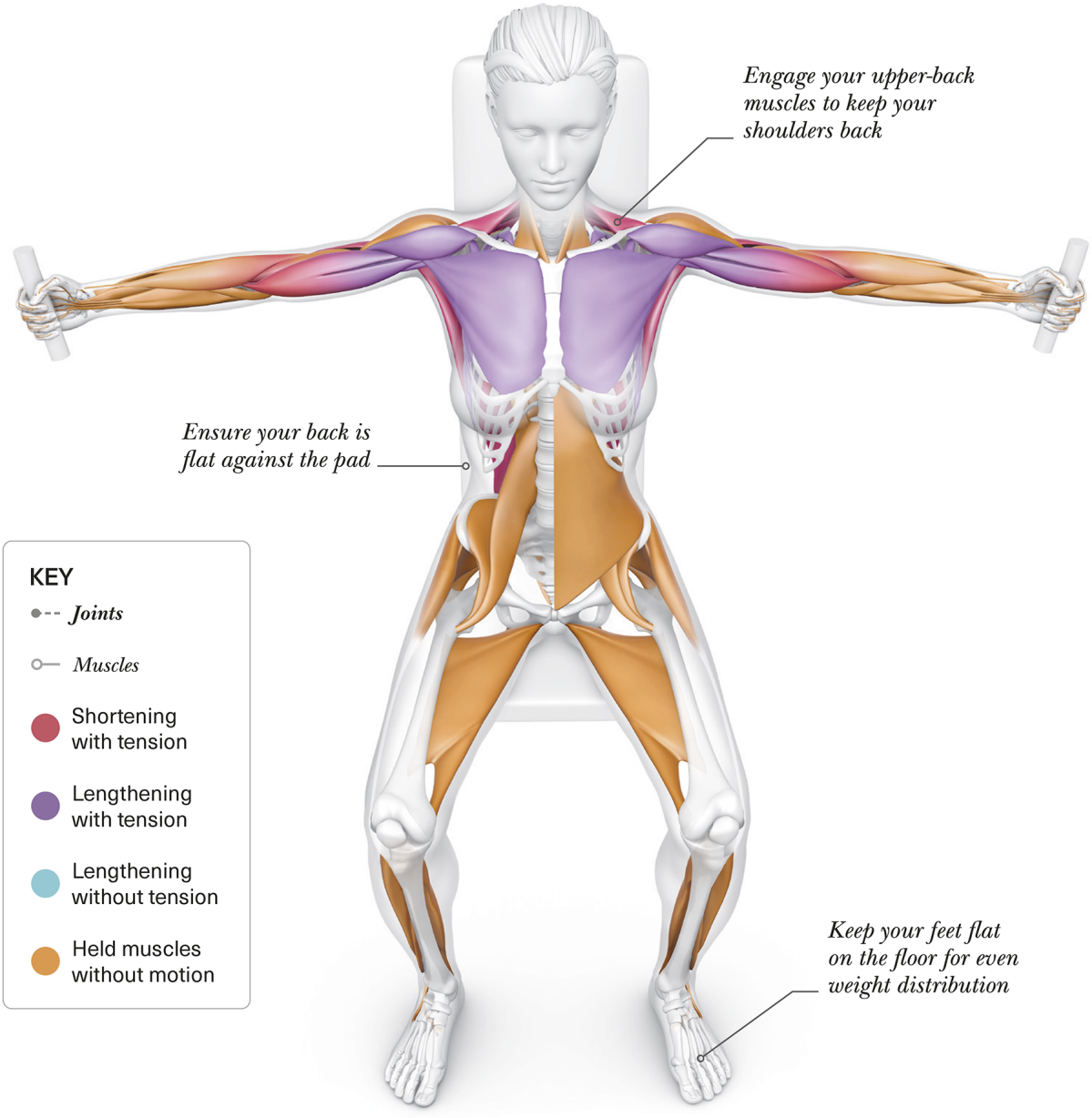
The **muscles of the chest** are receiving tension here. The muscles of the **arms**, **upper back**, and **shoulders** (including the **serratus anterior**) act more as secondary movers and stabilizers alongside the **muscles of the forearms**. Think about driving your upper arms toward the midline to maximize tension placed in the chest.

Legs

The **muscles of the lower body** will help provide your base of support during this move. Being stable allows you to create more tension in the target muscles. If you are a shorter individual, try putting down a step or small box for your feet to rest on, so that they maintain contact with the ground during the exercise.

STAGE TWO

Breathe in to engage your abs. As you exhale, engage the muscles of your upper back to aid in flying your arms back to the starting point, bending your elbows and keeping tension in your chest; keep the muscles of your upper back engaged. Reset your breathing then repeat stages 1 and 2.



Double-tap image to read the labels

Common mistakes

Straining at the shoulder joint – due to not correctly aligning the machine to your arm path – is commonly seen. Those who think about driving the handles or hands together should be instead focussing on driving the upper arms toward the midline to target the correct muscles.

DUMBBELL CHEST FLY

This exercise is isolation based: it places tension on just one area, the chest and front deltoids. Moving the weights far away from the midline allows gravity's effect to kick in, offering a greater challenge in the eccentric contraction (lower phase) than other versions of the chest fly.

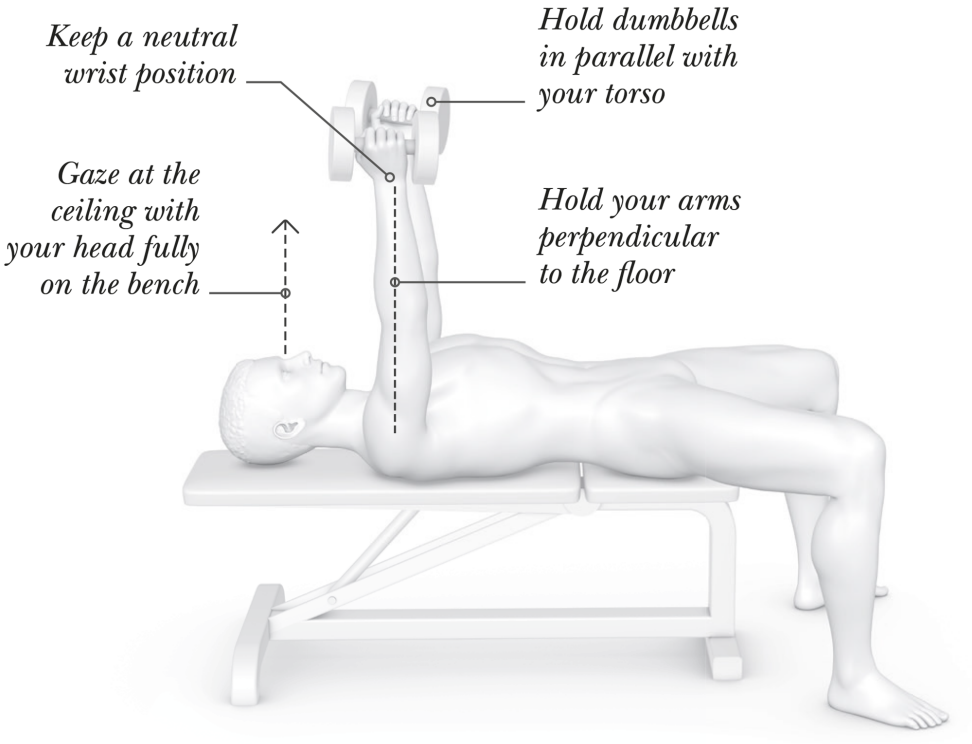
THE BIG PICTURE

You might find you have to work harder to perform a chest fly while lying down; it's also crucial to get the technique right to avoid injury. Ensure you decelerate at the bottom of the rep to avoid strain to muscles or joints. If you experience joint discomfort during this exercise, switch to the cable or machine versions (see High-Low Cable chest fly and Machine chest fly).

Beginners can start with 4 sets of 8–10 reps; discover other targeted sets in the training programmes.

PREPARATORY STAGE

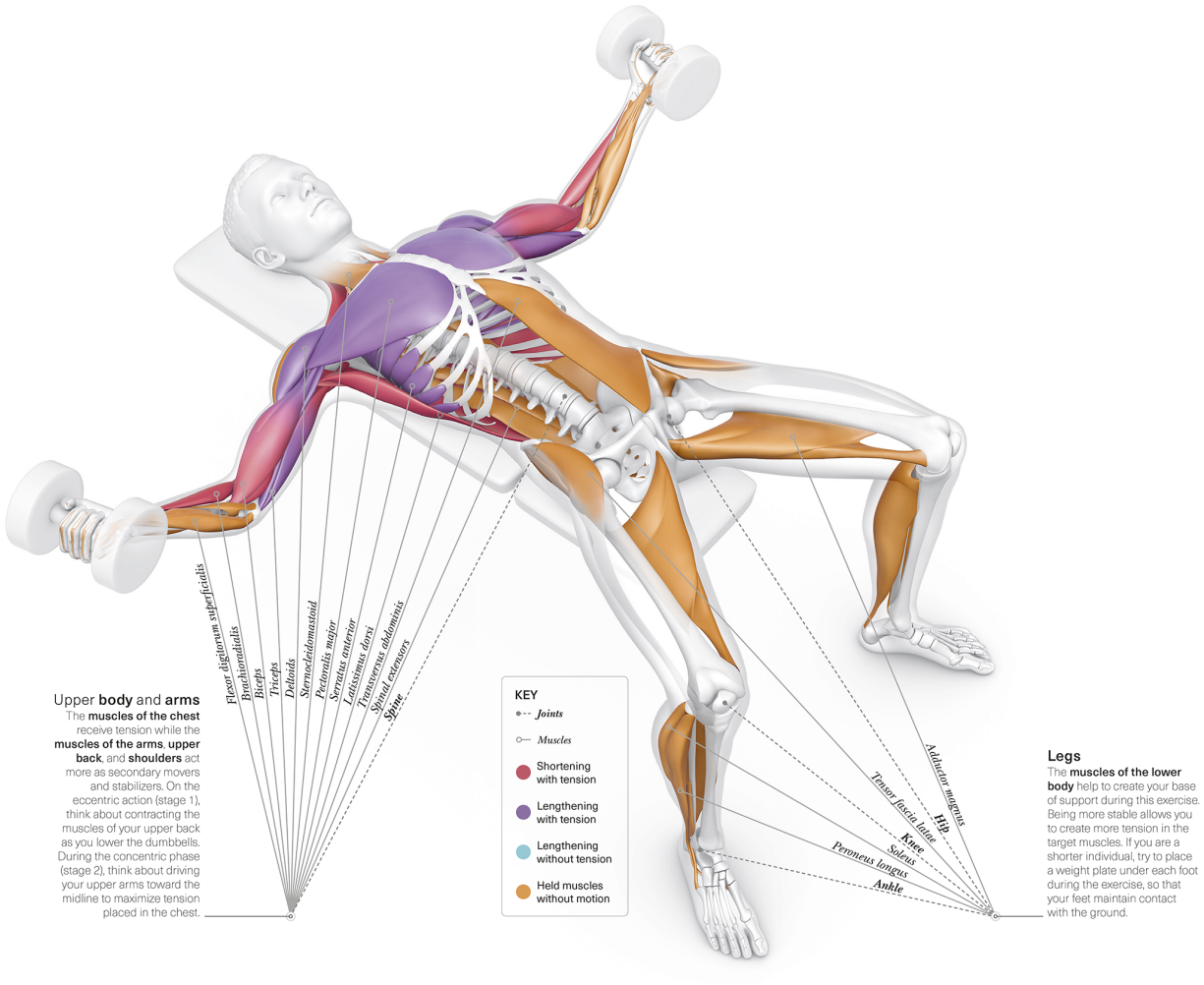
Lie flat with your buttocks fully on the bench and your feet flat on the floor, wider than hip-width apart. Hold the dumbbells at the sides of your body. Then raise the weights up above your chest, while keeping your head in a neutral position.



Double-tap image to read the labels

STAGE ONE

Breathe in and engage your core and upper back for stability. Breathe out as you fly your arms out to the sides, keeping tension in your chest and shoulders. The dumbbells should remain parallel with your torso.



Double-tap image to read the labels

SUPERIOR-ANTERIOR-LATERAL VIEW

Upper **body** and **arms**

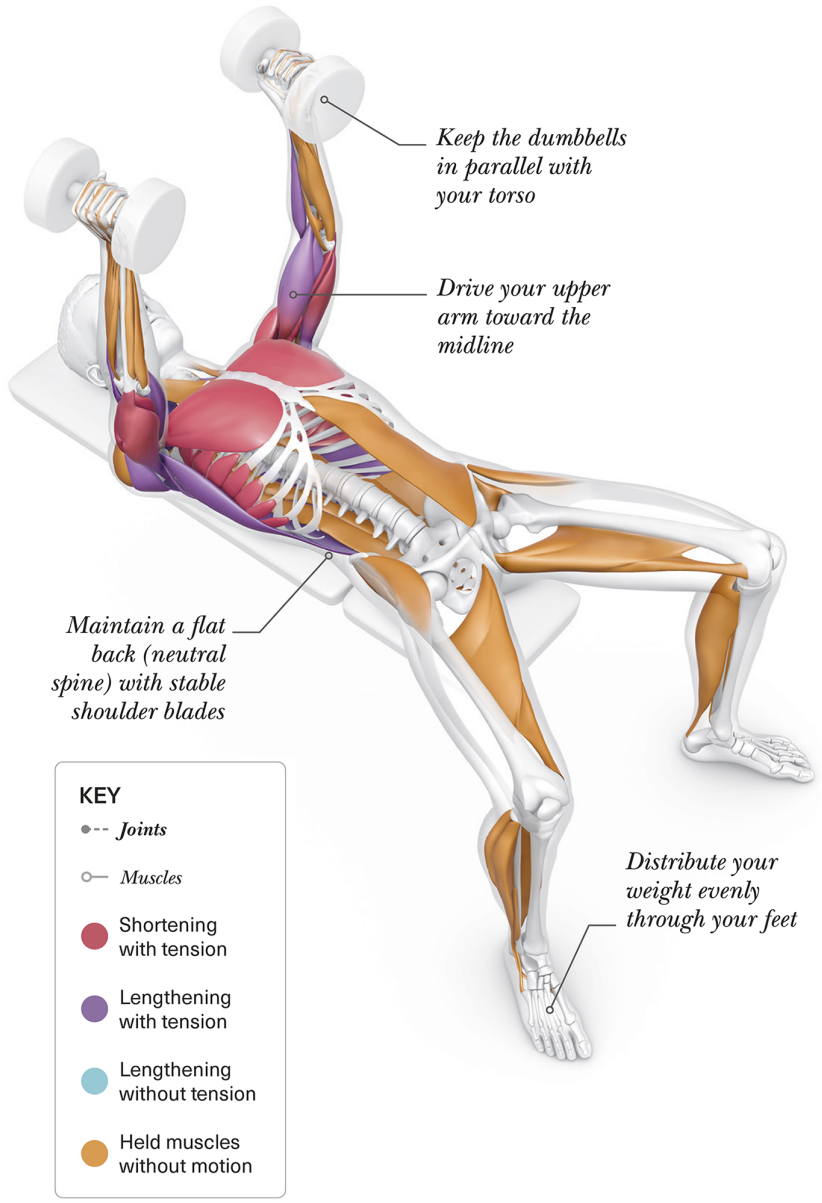
The **muscles of the chest** receive tension while the **muscles of the arms**, **upper back**, and **shoulders** act more as secondary movers and stabilizers. On the eccentric action (stage 1), think about contracting the muscles of your upper back as you lower the dumbbells. During the concentric phase (stage 2), think about driving your upper arms toward the midline to maximize tension placed in the chest.

Legs

The **muscles of the lower body** help to create your base of support during this exercise. Being more stable allows you to create more tension in the target muscles. If you are a shorter individual, try to place a weight plate under each foot during the exercise, so that your feet maintain contact with the ground.

STAGE TWO

With your abs and upper-back muscles engaged, place tension through your chest and shoulders to drive your upper arms across your chest toward the midline, while breathing out. The bend in your arms will naturally lessen. Hold the top position for 1 second to reset your breathing, then repeat stages 1 and 2.



Double-tap image to read the labels

Common mistakes

Strain at the shoulder joint is common in this exercise, so watch your technique. And keep a slight bend in your arms during the fly, to reduce strain on the biceps.

BACK EXERCISES

The main muscles responsible for movement in the back are: the latissimus dorsi (lats), the largest among the muscles nearest to the surface; the trapezius (traps), the other main superficial muscle; the rhomboids, positioned deep beneath the trapezius; and the spinal extensors, deep beneath the rhomboids.

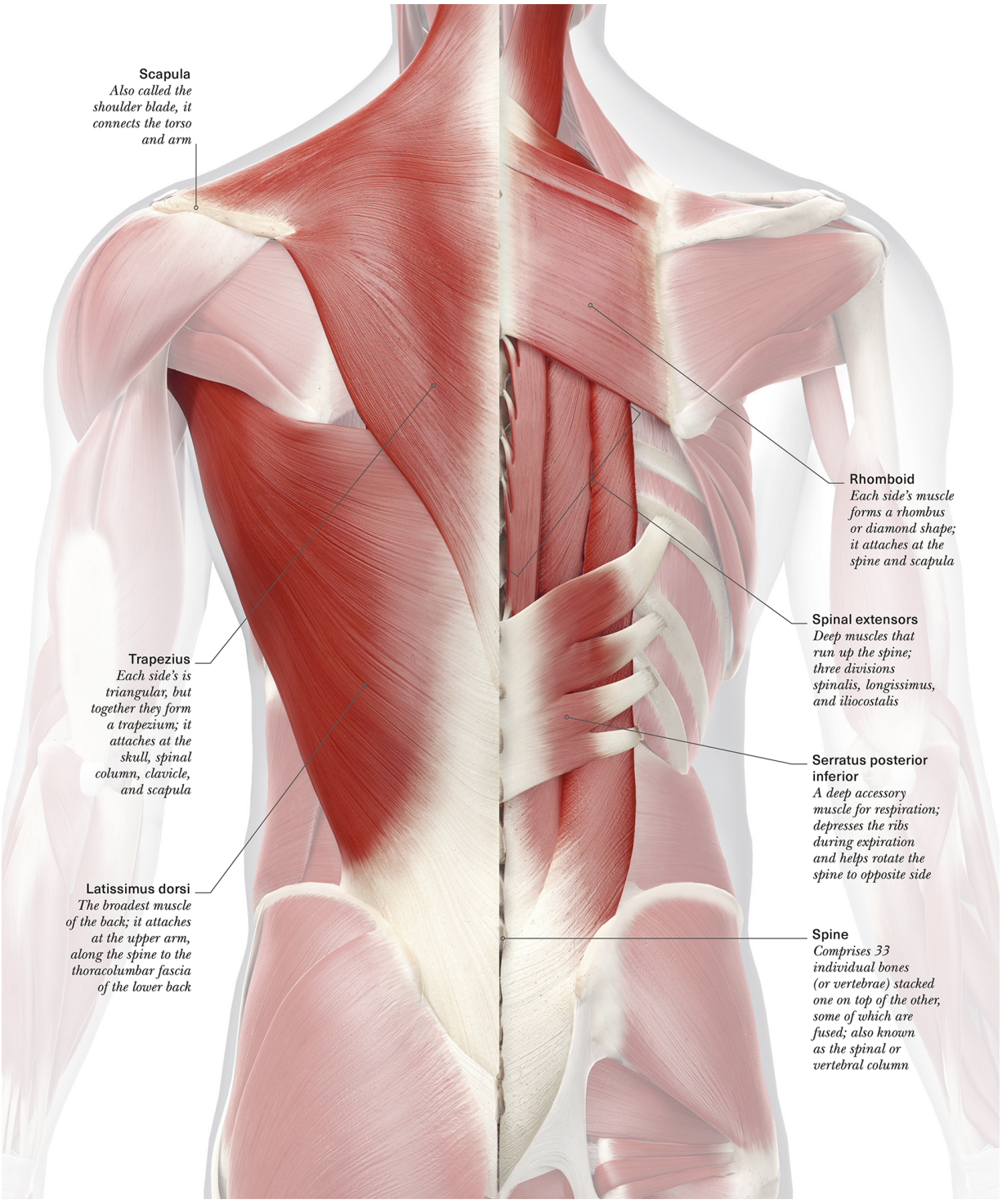
The lats attach to the upper arms and connective tissue around the lower back, while the traps and rhomboids attach to the scapulae and spine in the upper back. The spinal extensors attach to the pelvis, spine, and ribcage.

The muscles of the back enable extension, vertical and horizontal adduction, depression, and retraction of the shoulder, and extension and lateral flexion of the spine. They act as antagonists to muscles of the chest and torso, helping to stabilize and protect the spine in squats and deadlifts.

When performing rowing variations, muscles with a more horizontal fibre alignment, such as the middle division of the traps and upper lats, help to bring the arms back and around toward the midline.

When performing pulldown variations, muscles with a more vertical fibre alignment, such as the lower lats and upper and lower traps, help in bringing the arms down, back, and around toward the midline.

When performing any movement focussing on the back, you will be using any number of muscles in combination to complete the full range of motion, alongside muscles of the shoulders and arms.



ℹ Double-tap image to read the labels

SUPERFICIAL

Scapula
Also called the shoulder blade, it connects the torso and arm

Trapezius
Each side's is triangular, but together they form a trapezium; it attaches at the skull, spinal column, clavicle, and scapula

Latissimus dorsi
The broadest muscle of the back; it attaches at the upper arm, along the spine to the thoracolumbar fascia of the lower back

DEEP

Rhomboid
Each side's muscle forms a rhombus or diamond shape; it attaches at the spine and scapula

Spinal extensors
Deep muscles that run up the spine; three divisions spinalis, longissimus, and iliocostalis

Serratus posterior inferior
A deep accessory muscle for respiration; depresses the ribs during expiration and helps rotate the spine to opposite side

Spine
Comprises 33 individual bones (or vertebrae) stacked one on top of the other, some of which are fused; also known as the spinal or vertebral column

*“Strong back muscles enable a **wide range of movement patterns** in perfect **synchronicity**.”*

SECTION CONTENTS

Wide-grip vertical pulldown

Variations:

- Neutral-grip vertical pulldown
- Machine vertical pulldown
- Chin-up

Neutral-grip horizontal row

Variations:

- Machine horizontal row
- Dumbbell bent-over row
- Barbell bent-over row

Dumbbell trap shrug

Variations:

- Banded upright row
- Cable upright row
- Cable trap shrug

WIDE-GRIP VERTICAL PULLDOWN

Vertical pulling is a great exercise for supporting good posture and general mobility; the wide grip used in this variation of the exercise puts the focus on the muscles of the upper back and the latissimus dorsi, as well as training the biceps and rear deltoid muscles of the upper arm and shoulder.

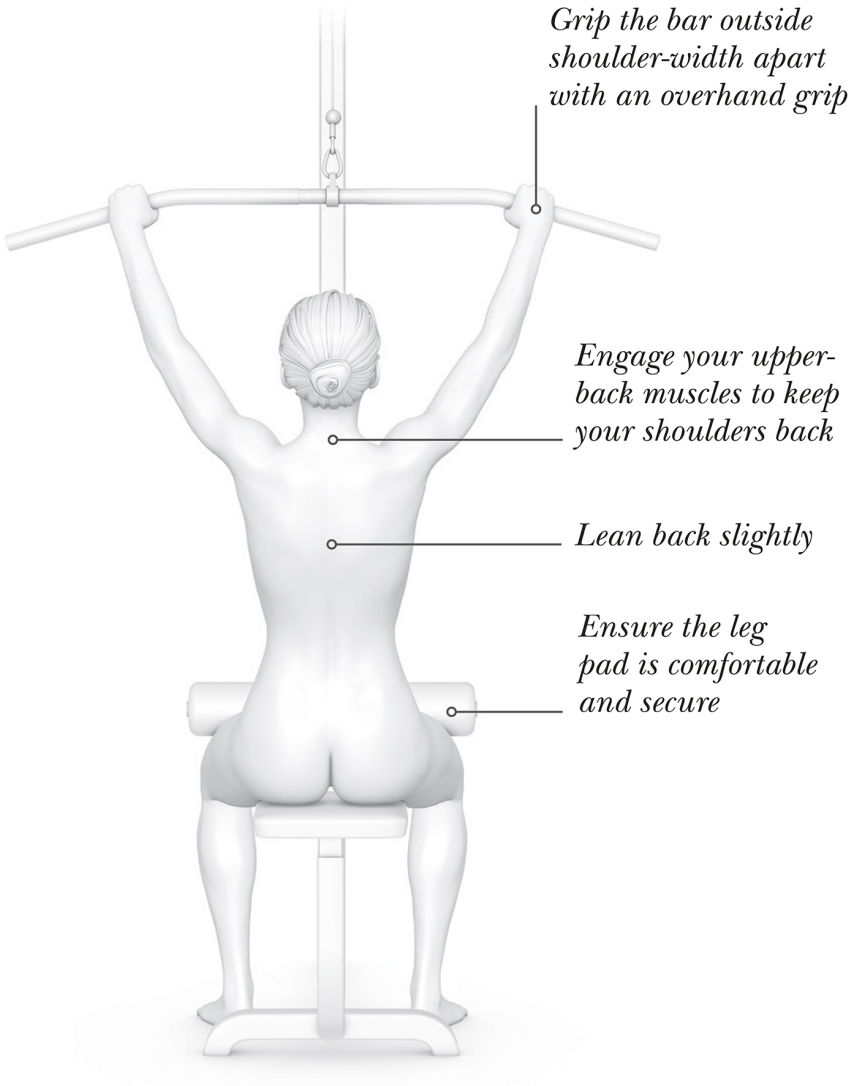
THE BIG PICTURE

A wide grip on the bar targets the upper back, whereas a more neutral grip works the lats and biceps more; to discover how a change of grip tweaks the muscles worked, see Wide-grip Vertical pulldown Variations. If you experience joint discomfort during this exercise, try adjusting your range of motion in stage 2 to place less stress on the shoulder joint.

Beginners can start with 4 sets of 8–10 reps; discover other variations to practise at home and other targeted sets in the training programmes.

PREPARATORY STAGE

Set the weights and adjust the seat height. Slide your thighs under the leg pad and sit with your knees bent and feet flat on the floor. Take hold of the bar and lean your torso back a little, slightly extending your upper back.

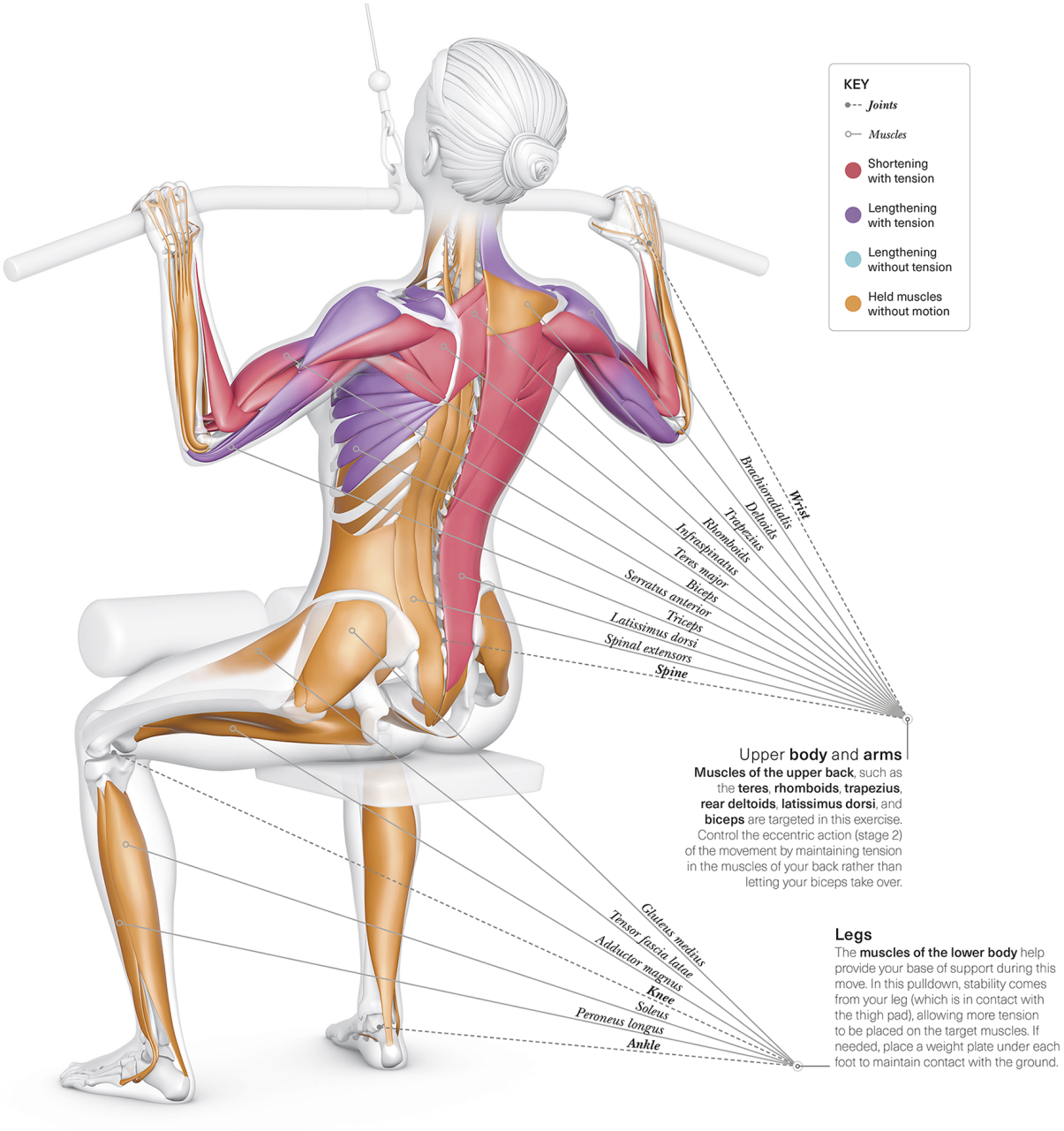


ⓘ Double-tap image to read the labels

STAGE ONE

Breathe in and engage your abs to stabilize and tighten your core. As you breathe out, pull the bar down by flexing at the elbows and contracting the muscles of your upper/mid back; your elbows will be

driven outward. Keep your chest high and pull the bar toward the top of your sternum (it doesn't have to touch you).



Double-tap image to read the labels

POSTERIOR-LATERAL VIEW

Upper **body** and **arms**

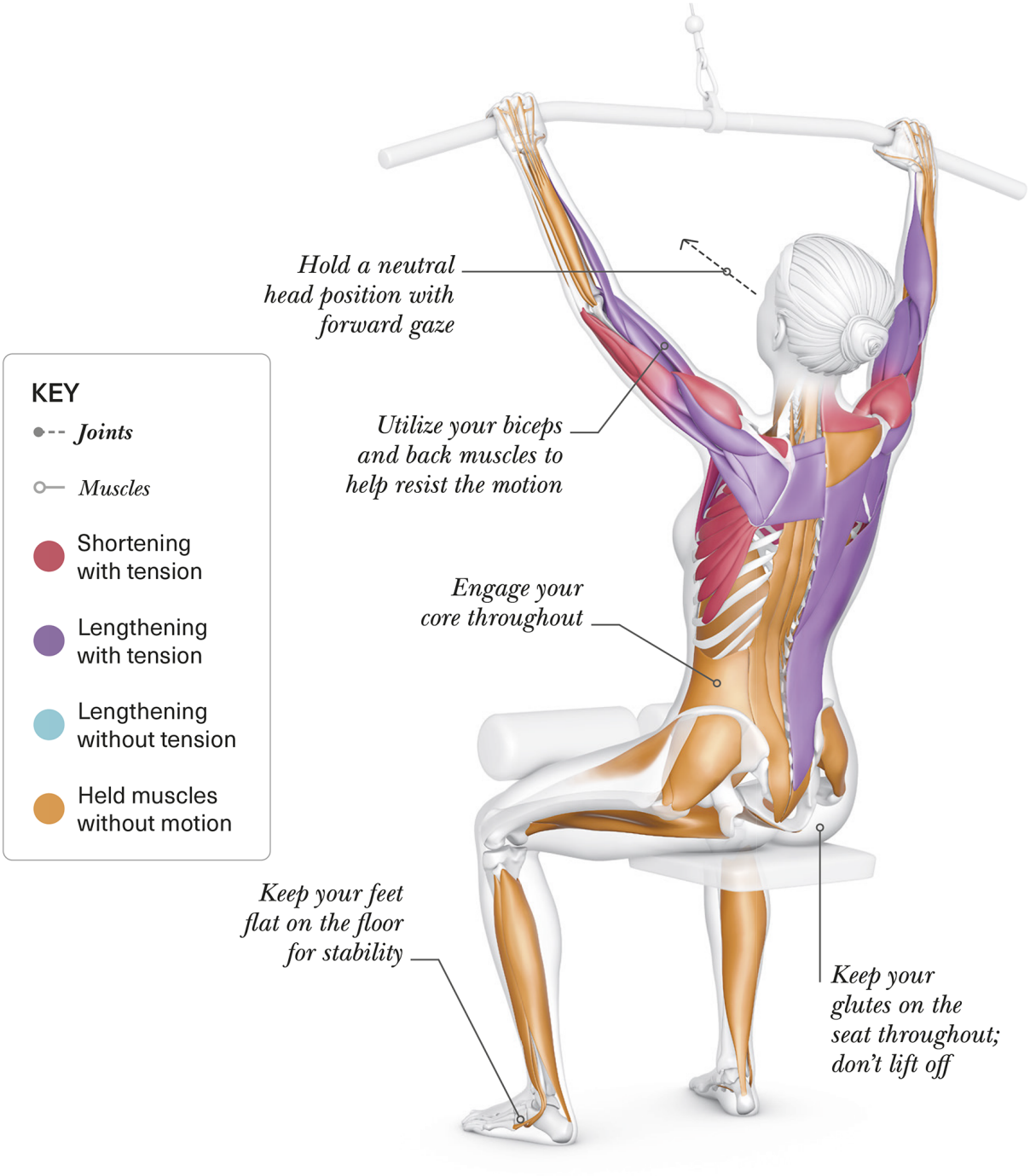
Muscles of the upper back, such as the **teres**, **rhomboids**, **trapezius**, **rear deltoids**, **latissimus dorsi**, and **biceps** are targeted in this exercise. Control the eccentric action (stage 2) of the movement by maintaining tension in the muscles of your back rather than letting your biceps take over.

Legs

The **muscles of the lower body** help provide your base of support during this move. In this pulldown, stability comes from your leg (which is in contact with the thigh pad), allowing more tension to be placed on the target muscles. If needed, place a weight plate under each foot to maintain contact with the ground.

STAGE TWO

Keeping your abs engaged, breathe in to return the bar to the starting position, with control; keep tension in your back and biceps throughout. Reset your breathing and repeat stages 1 and 2. To add challenge, pause for 1–2 seconds at the top or bottom position.



Double-tap image to read the labels

VARIATIONS

The motion of a vertical pulldown can be adapted to various pieces of equipment. Adjusting your grip will alter the specific muscles being targeted, including the lats, traps, and delts. Again, take care not to place too much stress on your shoulder joints during these moves.

NEUTRAL-GRIP VERTICAL PULLDOWN

Where the wider, pronated grip on the pulldown on the previous pages targets the upper-back muscles, this variation with a neutral grip – with palms facing each other – helps bias the latissimus dorsi.

PREPARATORY STAGE

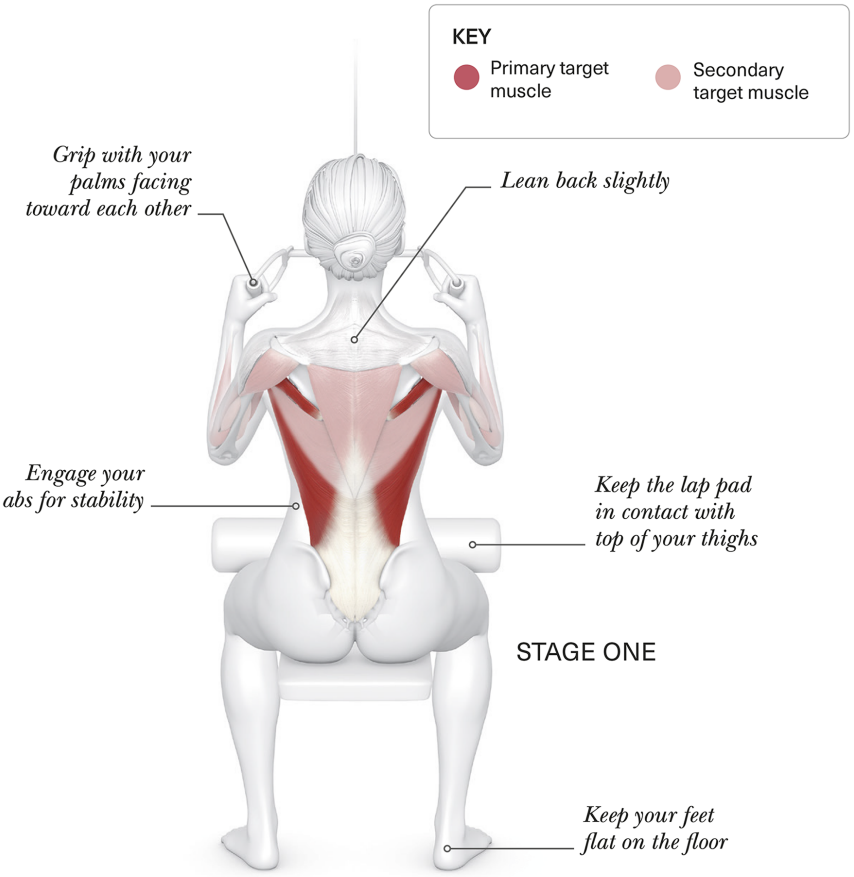
Position your body as for a wide-grip pulldown. Your hands should be shoulder-width apart in a neutral grip. Lean your torso back slightly.

STAGE ONE

Breathe in and engage your abdominal muscles. Breathe out as you pull the bar down by flexing at the elbows and contracting the lats.

STAGE TWO

Breathe in again and engage your abdominal muscles. Return the bar to the starting position, maintaining control. Repeat stages 1 and 2.



Double-tap image to read the labels

MACHINE VERTICAL PULLDOWN

This machine variation allows for either a pronated wide grip or a neutral grip, while providing a fixed path of resistance from the machine. This wide-grip version targets more of the traps than the neutral-grip one.

PREPARATORY STAGE

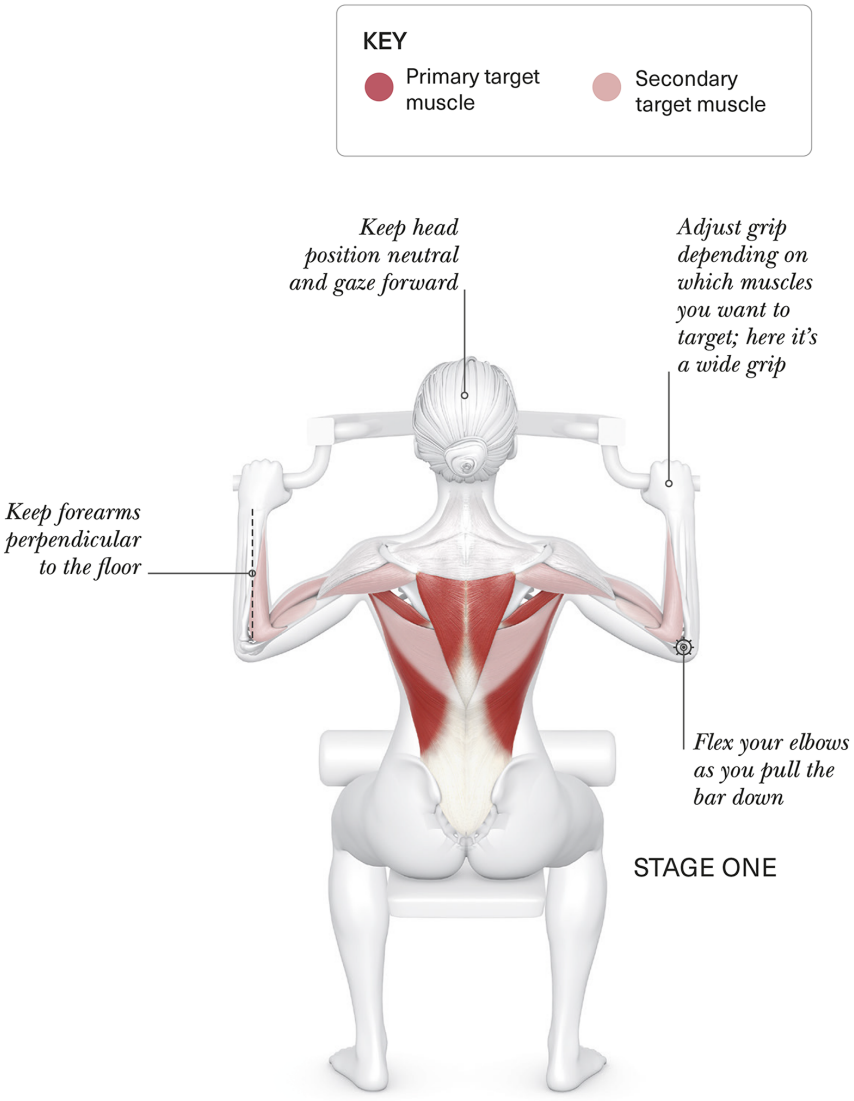
Set up the machine. Sit with your thighs under the leg pad, knees bent, and with your feet on the floor. Hold onto the handles using your preferred grip.

STAGE ONE

Breathe in and engage your abdominals, then breathe out as you pull the bar down, contracting the muscles of your upper/mid-back.

STAGE TWO

Breathe in again and engage your core, then, maintaining control, breathe out to return the bar to its starting position. Repeat stages 1 and 2.



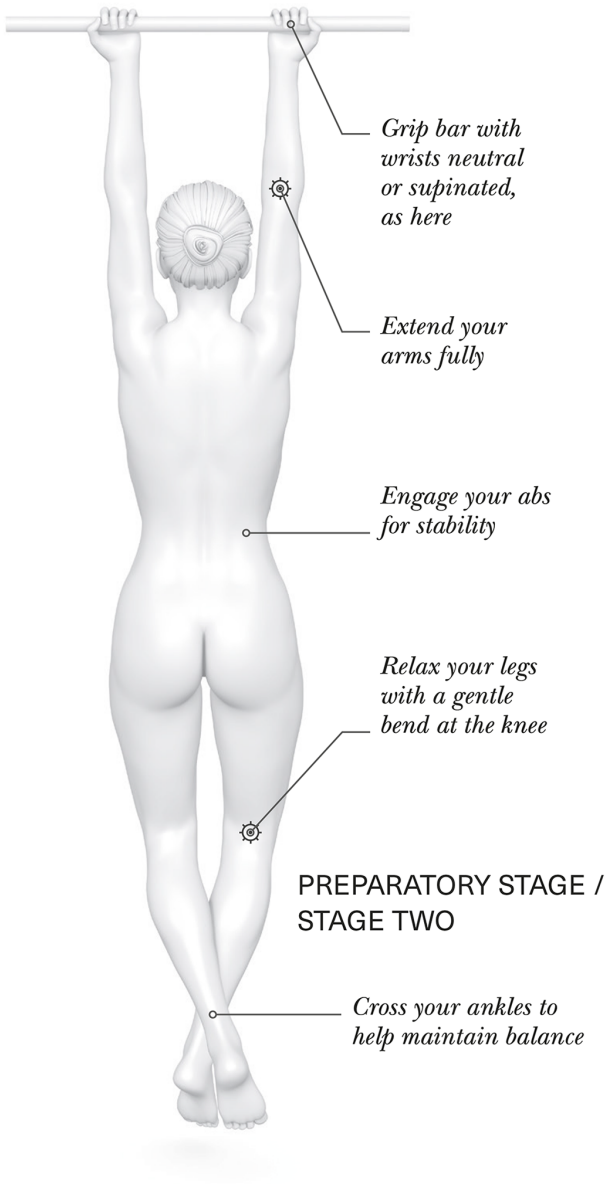
Double-tap image to read the labels

CHIN-UP

This exercise trains the upper back, lats, and biceps. Bodyweight vertical pulling is a great addition to every strength programme, and this neutral-grip variation trains a large portion of the back with each rep.

PREPARATORY STAGE

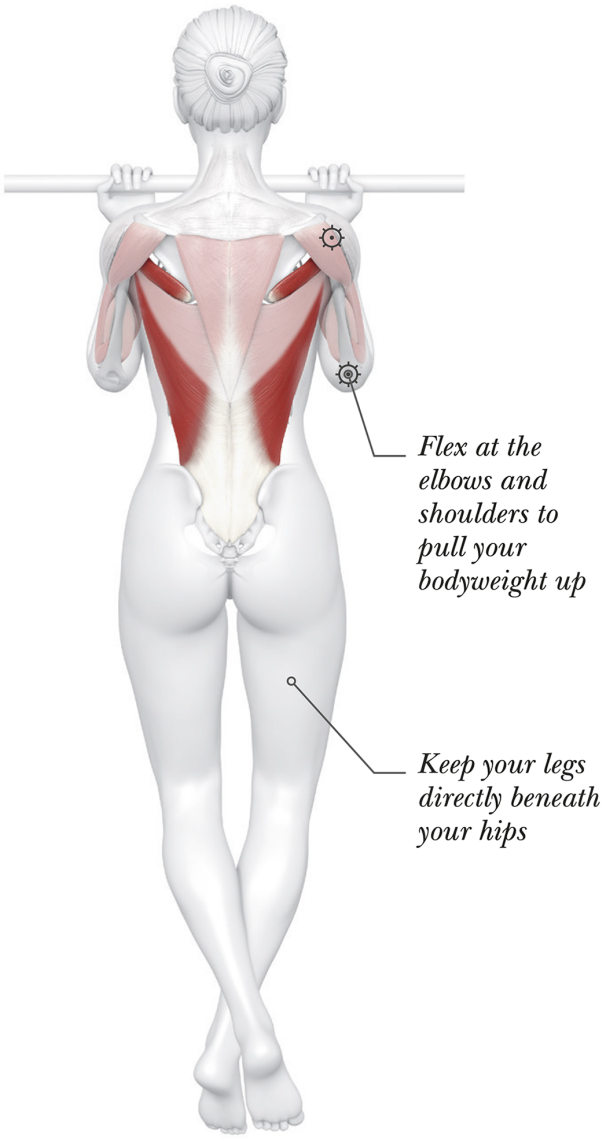
Start in a hanging position with your core stabilized. You can cross one foot over the other at your ankle, to help maintain balance and coordination.



Double-tap image to read the labels

STAGE ONE

Breathe out as you flex your elbows to pull yourself off the ground. To make the exercise more challenging, pause in this position for 1–2 seconds.

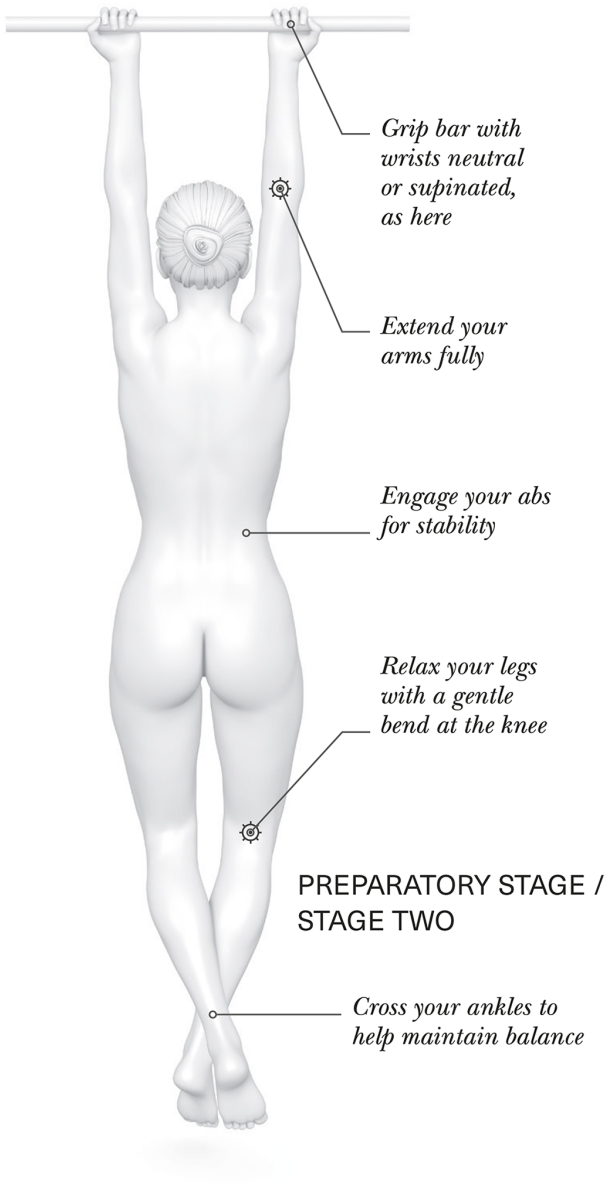


STAGE ONE

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STAGE TWO

Breathe in as you extend your elbows to lower your body, keeping your core engaged. Do not swing to create momentum. Repeat stages 1 and 2.

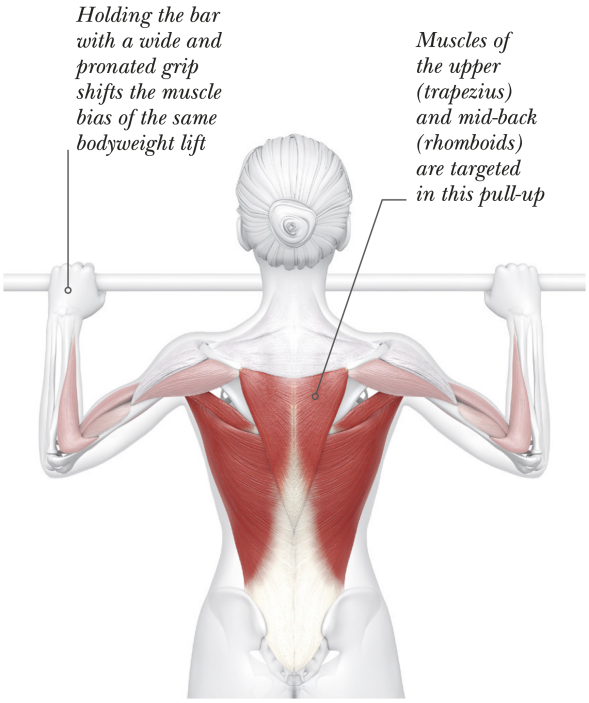


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*"**Your grip** will influence which **muscles will be more biased** over others during a **pulldown** variation."*

A matter of **grip**

Having your hands close together and in a more neutral, semi-, or supinated grip will allow you to perform a chin-up, which involves more lats and biceps relative to the upper back. The wider and more pronated grip results in a pull-up, with more upper-back focus while still training the biceps, but less lats overall.



Double-tap image to read the labels

NEUTRAL-GRIP **HORIZONTAL ROW**

Horizontal pulling fits well into any strength training programme; this neutral-grip variation trains a large portion of the upper back, lats, and biceps. Finding the correct position on the bench – not too close to the apparatus – is key to ensuring you are working with a full range of motion.

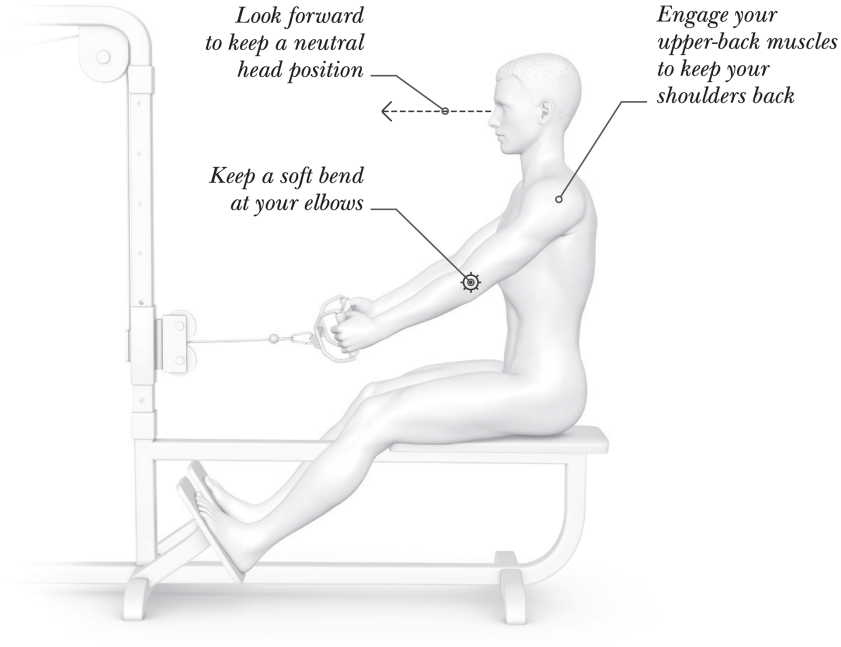
THE **BIG PICTURE**

Place your feet low down on the foot platform to allow for more flexibility at the hip. If you experience any shoulder discomfort, try adjusting your range of motion in stage 2.

Beginners can start with 4 sets of 8–10 reps; discover other variations to practise and other targeted sets in the training programmes.

PREPARATORY STAGE

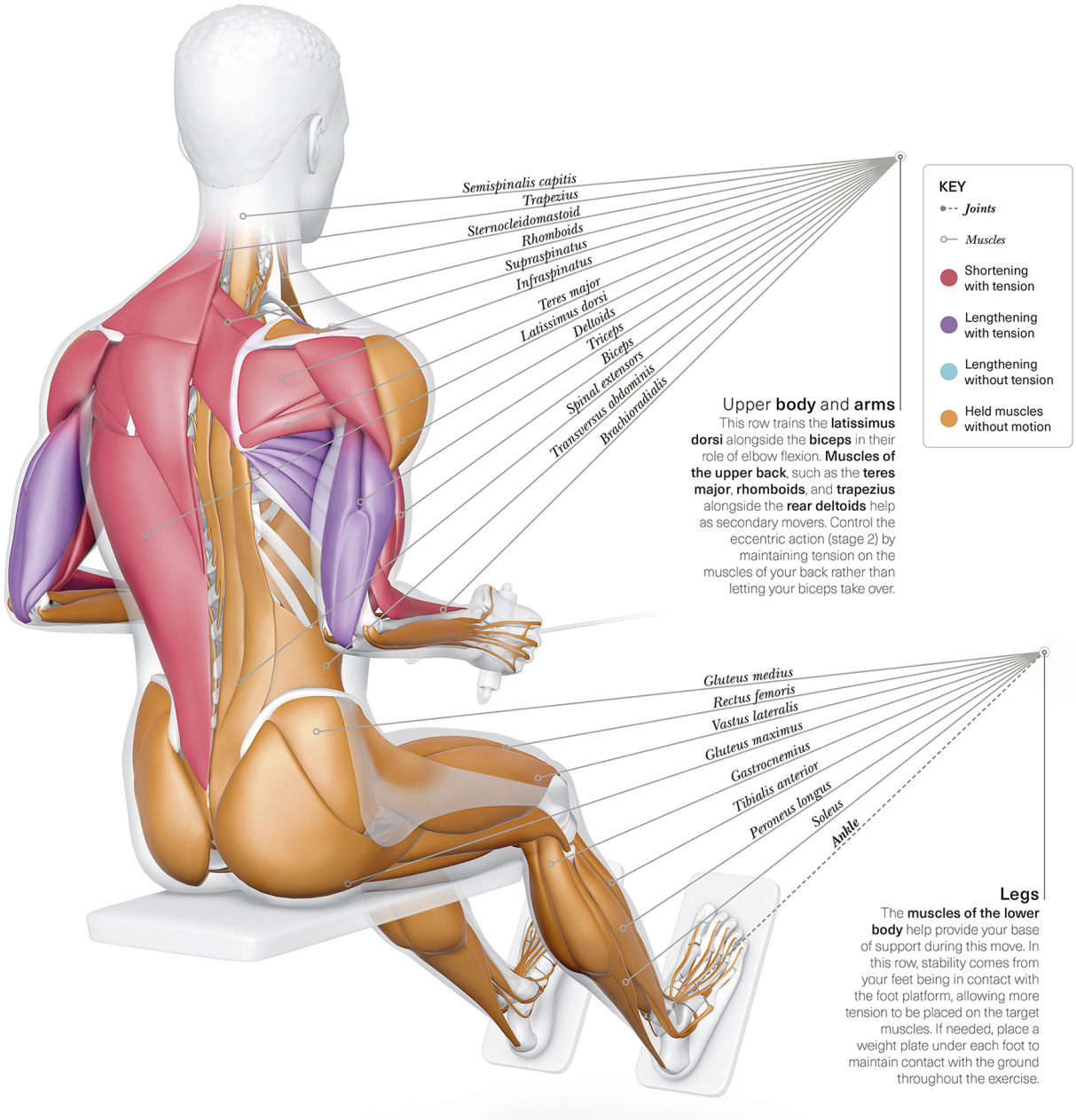
Set the weights and adjust the seat height, then sit on the bench, facing the machine; your feet should be low down on the platform and your legs softly bent. Hold the attachment with your hands shoulder-width apart and sit back, arms extended and back upright.



Double-tap image to read the labels

STAGE ONE

Breathe in and engage your abs. As you exhale, flex your elbows and contract your upper/mid back muscles to row the attachment toward your upper abdomen; your elbows will be driven back. Stop just before your shoulders start to round forward.



ℹ Double-tap image to read the labels

POSTERIOR-LATERAL VIEW

Upper **body** and **arms**

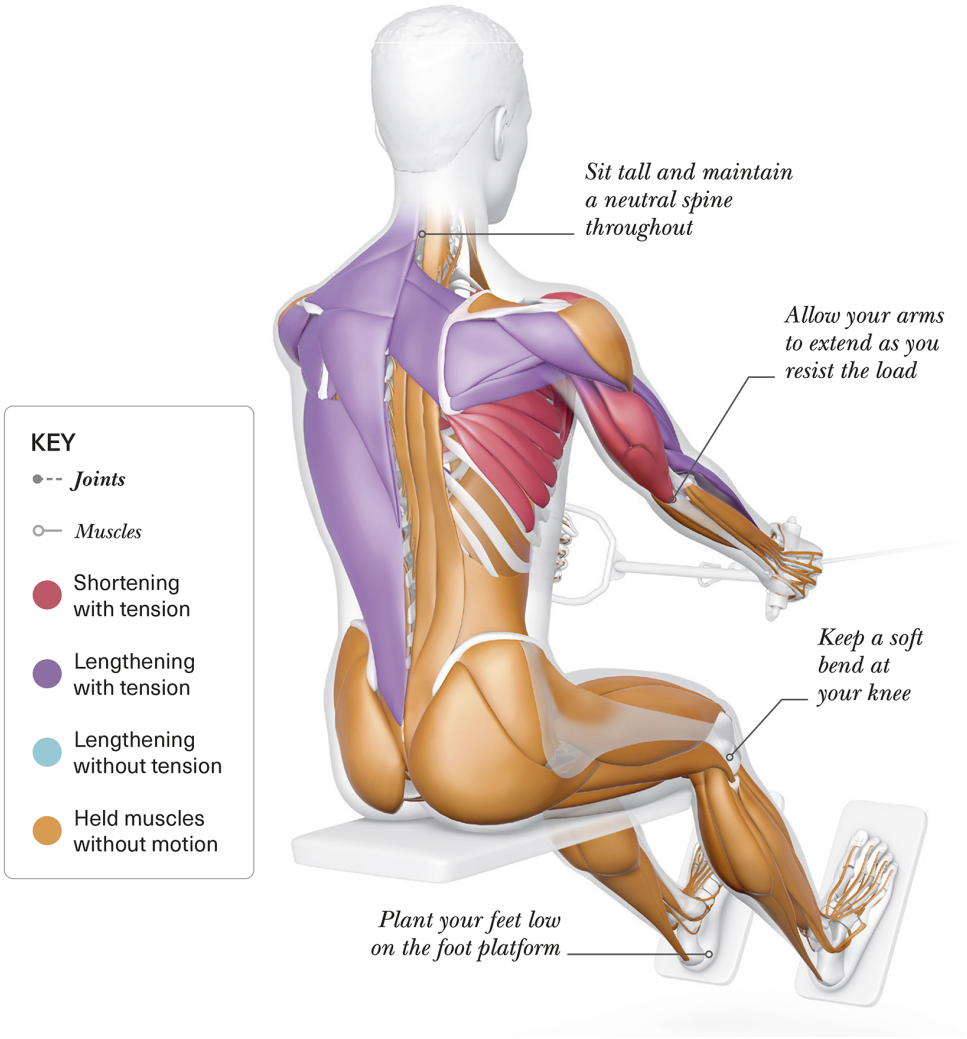
This row trains the **latissimus dorsi** alongside the **biceps** in their role of elbow flexion. **Muscles of the upper back**, such as the **teres major**, **rhomboids**, and **trapezius** alongside the **rear deltoids** help as secondary movers. Control the eccentric action (stage 2) by maintaining tension on the muscles of your back rather than letting your biceps take over.

Legs

The **muscles of the lower body** help provide your base of support during this move. In this row, stability comes from your feet being in contact with the foot platform, allowing more tension to be placed on the target muscles. If needed, place a weight plate under each foot to maintain contact with the ground throughout the exercise.

STAGE TWO

With your abs engaged, breathe in as you return the bar to the starting position, resisting the load with control; keep tension in your back and biceps throughout. Reset your breathing and repeat stages 1 and 2. To increase the challenge, pause for 1 second either here or after stage 1.



ℹ Double-tap image to read the labels

Common mistakes

Many people make the mistake of generating momentum at the hip and torso, which will cause you to lean back rather than rowing back. Aim to keep your core in a fixed position throughout.

VARIATIONS

A rowing movement targets the latissimus dorsi, other back muscles, and the biceps. You can adapt this exercise to your range of equipment. Keep your torso stable and move your shoulders and arms back in a fluid motion on each rep.

MACHINE HORIZONTAL ROW

This alternative machine-based variation trains the upper- and mid-back muscles. The chest support provided by the machine creates a stable and safe environment. For more of a challenge, hold at the top position for 1–2 seconds.

PREPARATORY STAGE

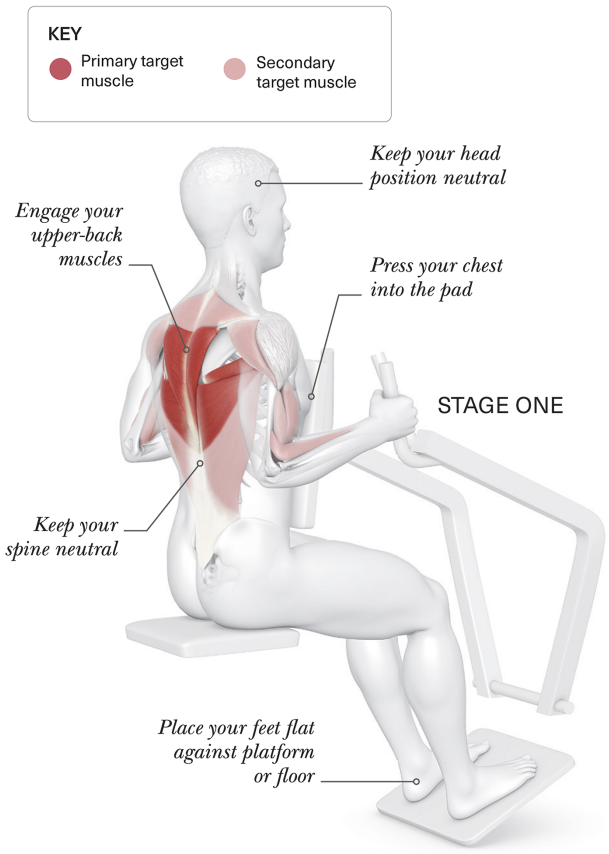
Sit on the machine and place your feet against the platform if there is one. Lean forward and place your chest against the pad.

STAGE ONE

Inhale to engage your abs. Breathe out as you pull the attachment toward you, bringing your shoulders back and arms behind you in one continuous motion.

STAGE TWO

Breathe in as you return the bar to its starting position, controlling the movement throughout. Repeat stages 1 and 2.



ℹ Double-tap image to read the labels

DUMBBELL BENT-OVER ROW

Using dumbells allows you to perform the movement either unilaterally, with one leg supported on a bench as here, or bilaterally, with both legs flexed at the knees, and your hips flexed at 90°. For more of a challenge, hold the top position for 1–2 seconds.

PREPARATORY STAGE

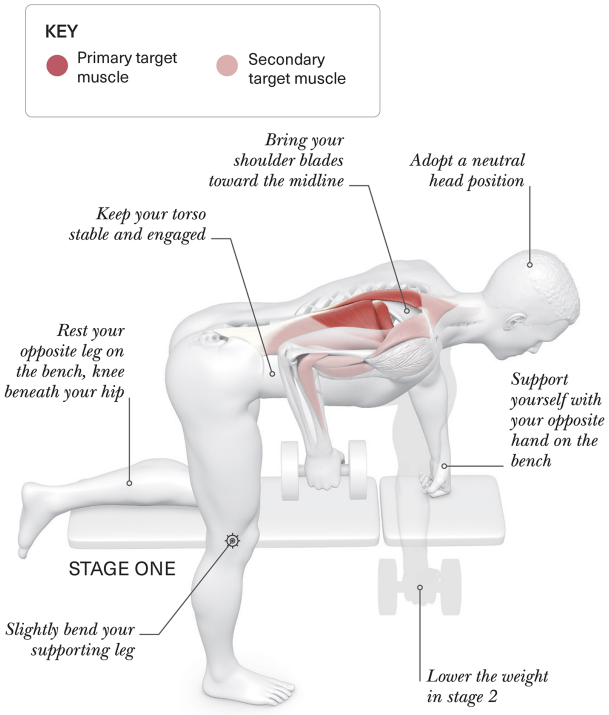
Place your opposite knee on the bench and position your other leg beneath your hip. Lean forward so your back is flat and breathe in to brace your core.

STAGE ONE

Breathe out as you retract your shoulder blades and drive your arm up, flexing your elbow between 30° and 75°; the angle changes the muscle bias.

STAGE TWO

Breathe in as you lower the dumbbell in a controlled movement, keeping your abs engaged. Repeat stages 1 and 2.



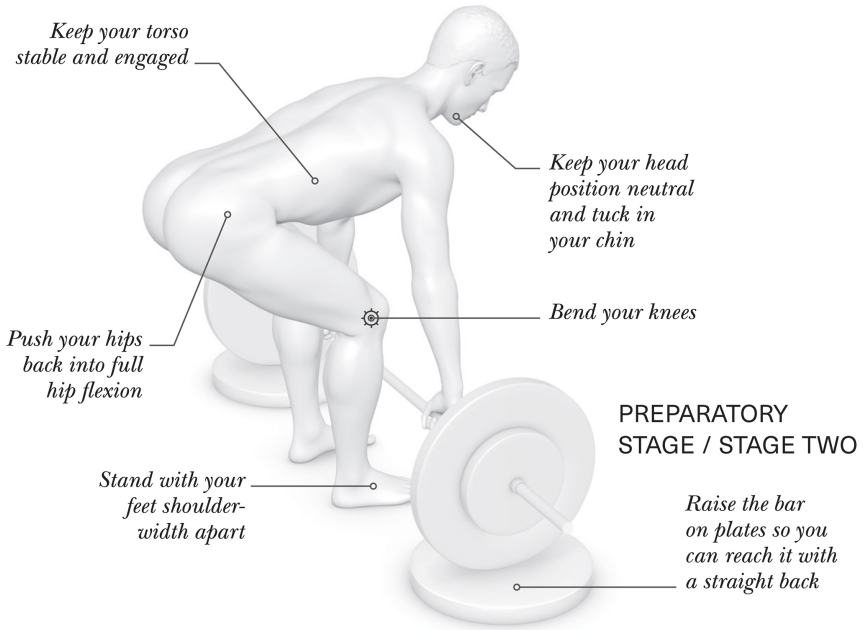
Double-tap image to read the labels

BARBELL BENT-OVER ROW

This popular barbell variation targets the muscles of the core in addition to those of the upper and mid-back. Be aware that your range of motion may decrease when standing. As with the other variations, hold at the top position for 1–2 seconds for added challenge.

PREPARATORY STAGE

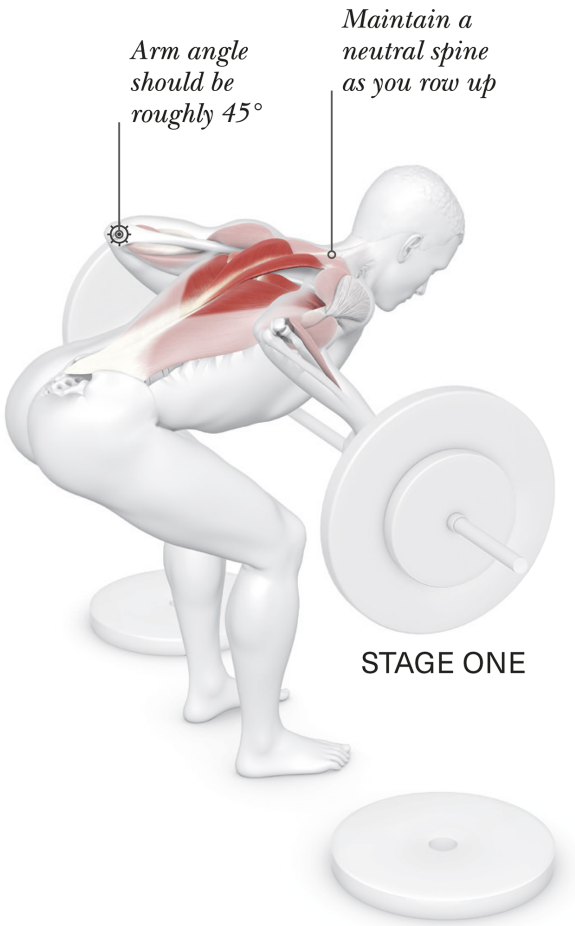
Stand bending forward and hold the barbell in your hands with a pronated grip, without sacrificing your neutral spine position.



ℹ Double-tap image to read the labels

STAGE ONE

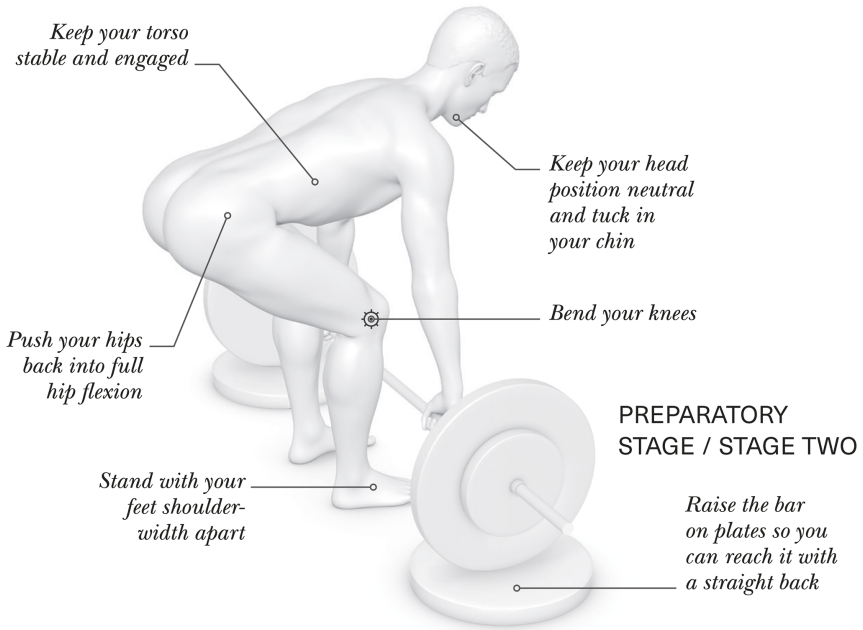
Breathe in to brace your core, then breathe out as you row up, lifting the bar toward your chest and bringing your elbows back behind your body.



Double-tap image to read the labels

STAGE TWO

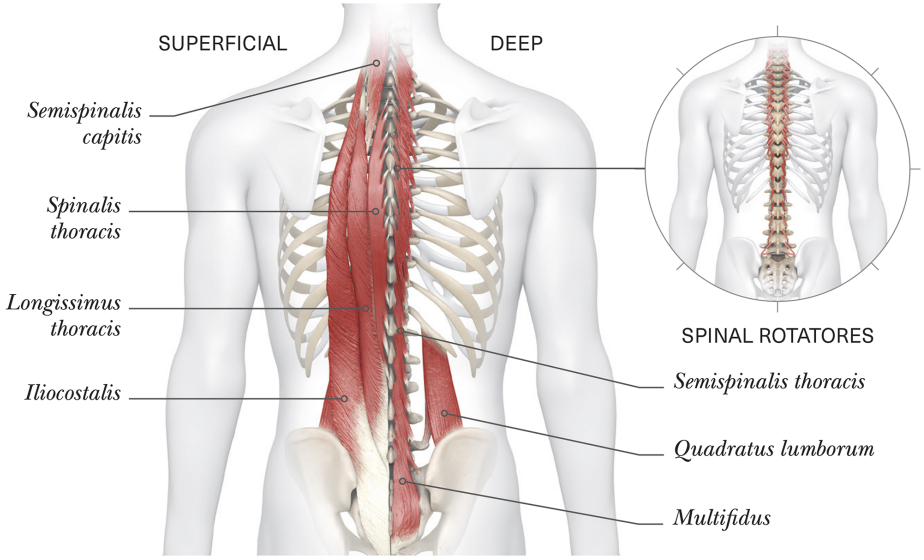
Breathe in as you lower the barbell to its starting position, maintaining control in your arms, shoulders, back, and core. Repeat stages 1 and 2.



ⓘ Double-tap image to read the labels

Spinal **extensors**

The superficial extensors (erector spinae) muscle group extends up the vertebral column and is made up of three divisions: spinalis, longissimus, and iliocostalis. The deep extensor muscles (including the rotatores) support the mobility work of the erector spinae and crucially help to stabilize the spine and the pelvis. Together, these muscles work tirelessly to keep the body from falling forward and help maintain good posture.



Double-tap image to read the labels

POSTERIOR VIEW

DUMBBELL TRAP SHRUG

This exercise trains the upper trapezius muscles (or traps) in a safe and effective way; the extra load of two dumbbells makes your muscles work even harder.

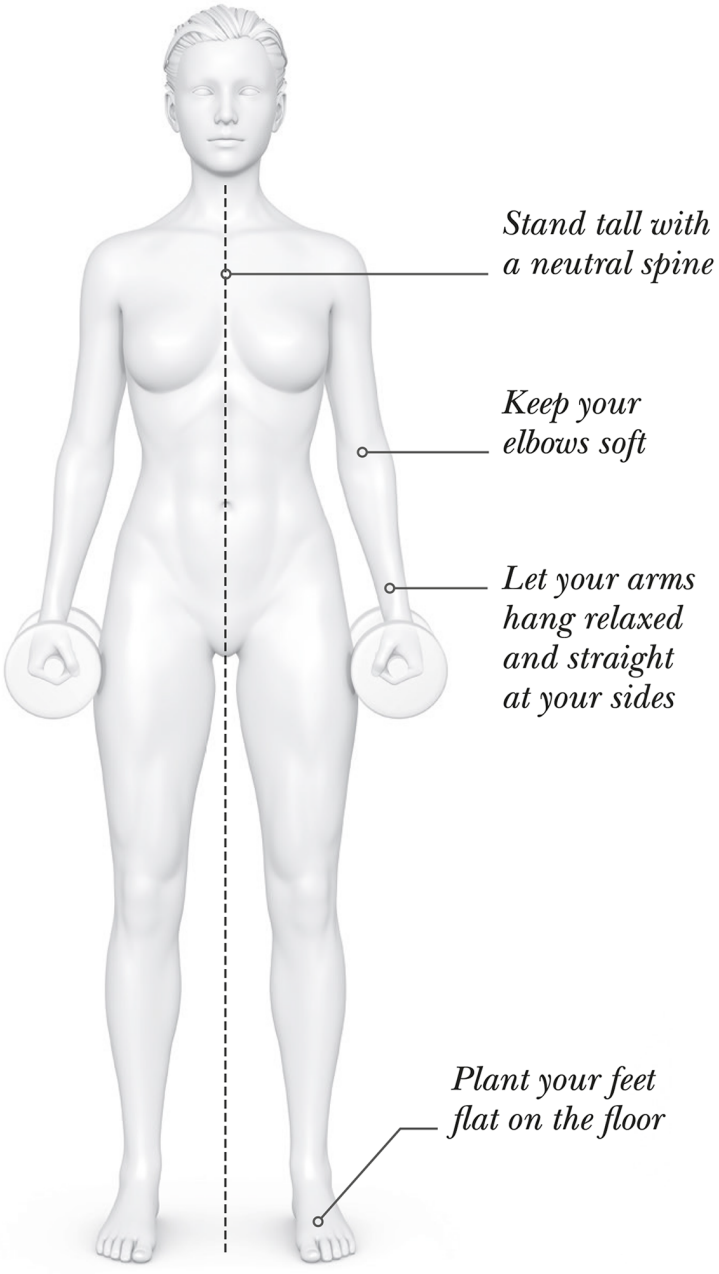
THE BIG PICTURE

Using dumbbells rather than a barbell removes the constraints of the bar, so you can adapt your form to your individual mechanics and mobility limitations. If you have access to a machine, the cable variation allows for the greatest individualization and best resistance.

Beginners can start with 4 sets of 8–10 reps; discover other variations and other targeted sets in the training programmes. If you experience discomfort during this exercise, try the cable or resistance-band variations overleaf.

PREPARATORY STAGE

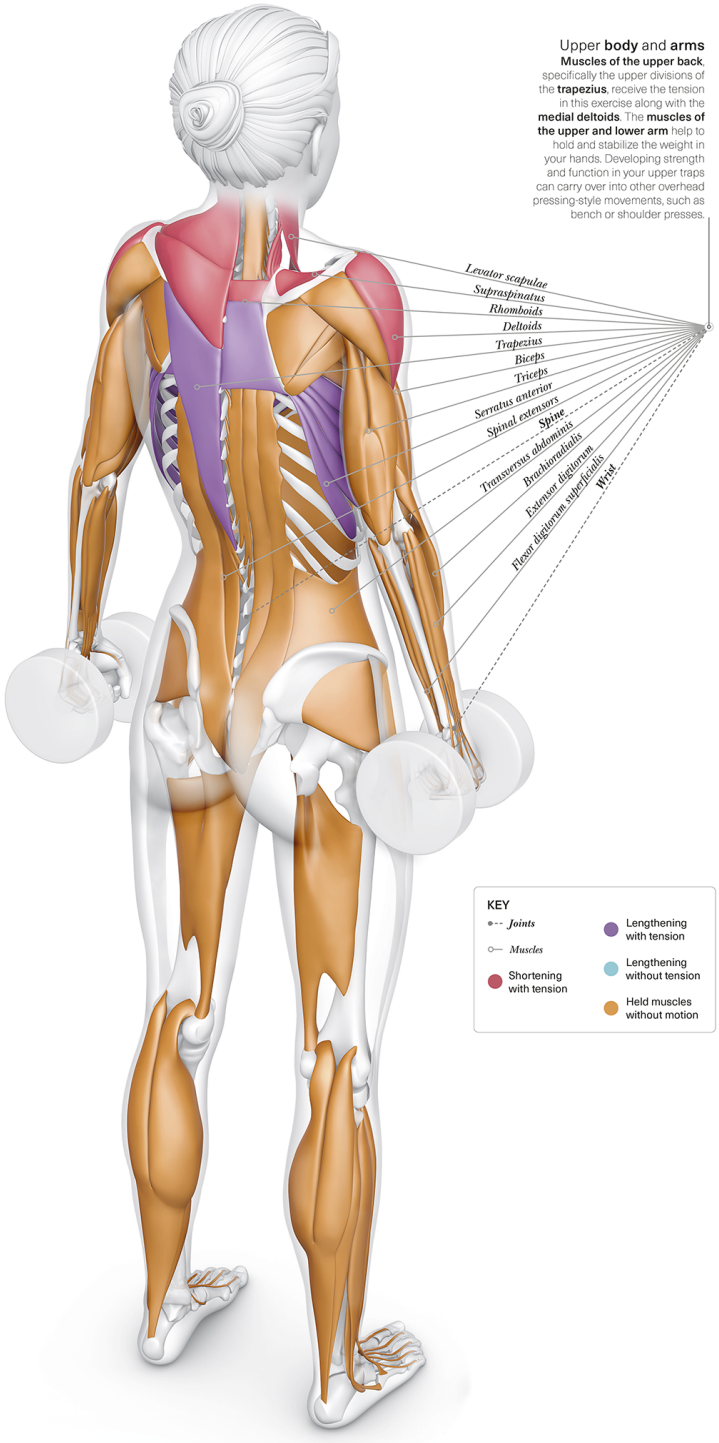
Stand with your feet shoulder-width apart. Grip the dumbbells with a neutral wrist position (palms facing inward) and hold them at the sides of your body. Keep a neutral head position – do not look up or down.



Double-tap image to read the labels

STAGE ONE

Take a breath in and engage your abs. Keeping your torso stable, exhale as you shrug your shoulders up toward your ears, taking both dumbbells upward. Stand still without any movement at your hips or torso. Hold for 1–2 seconds.



ℹ Double-tap image to read the labels

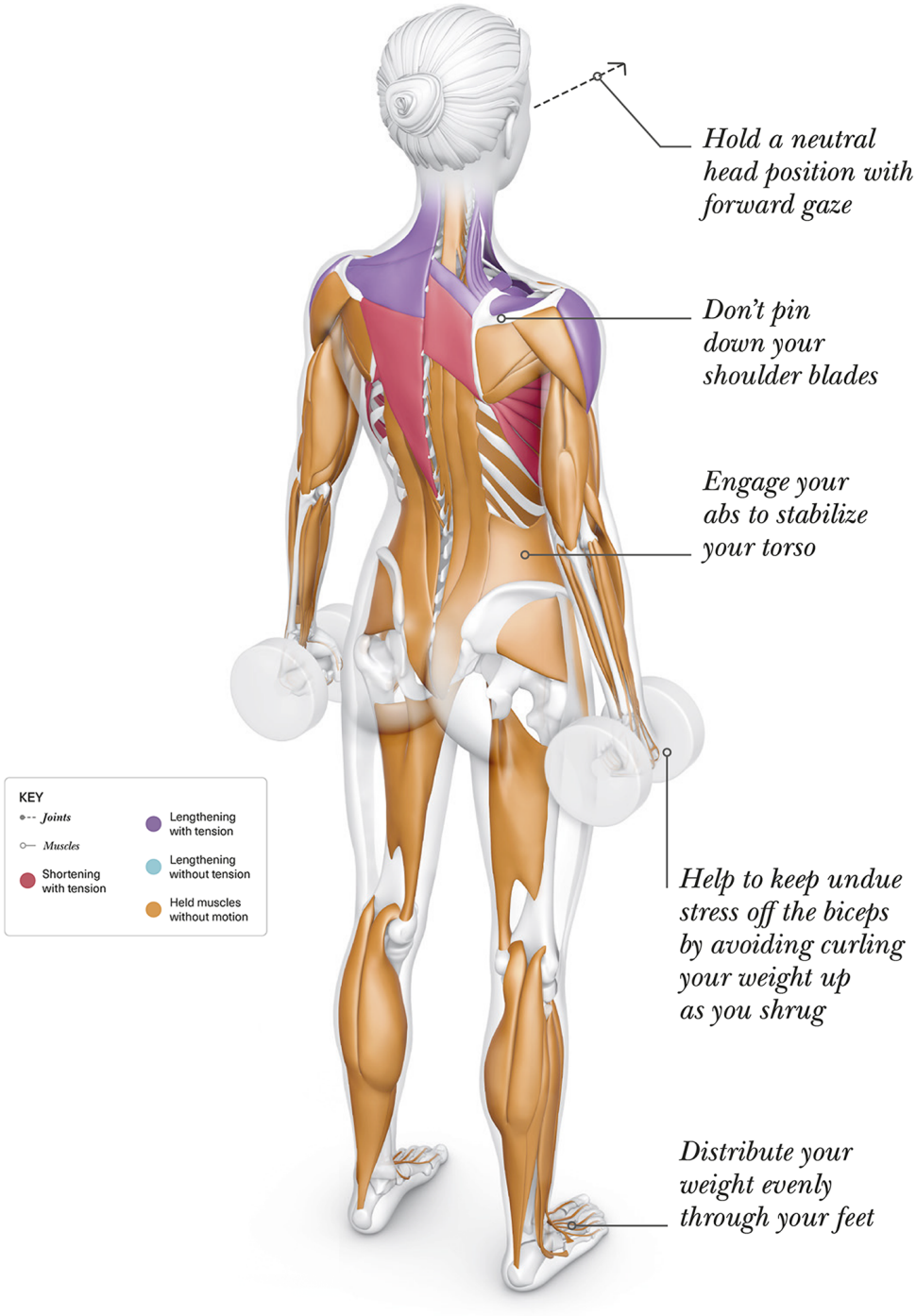
POSTERIOR-LATERAL VIEW

Upper **body** and **arms**

Muscles of the upper back, specifically the upper divisions of the **trapezius**, receive the tension in this exercise along with the **medial deltoids**. The **muscles of the upper and lower arm** help to hold and stabilize the weight in your hands. Developing strength and function in your upper traps can carry over into other overhead pressing-style movements, such as bench or shoulder presses.

STAGE TWO

Keeping your core engaged, breathe in as you return the weights to the starting position, resisting the lowering motion of the dumbbells with your upper traps. Reset your breathing and repeat stages 1 and 2.



Double-tap image to read the labels

VARIATIONS

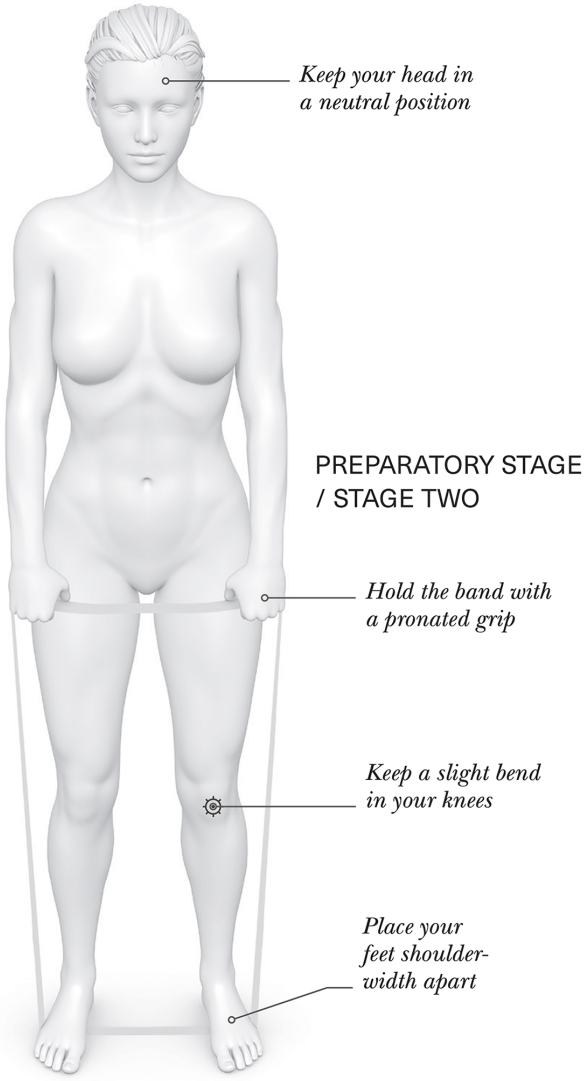
These versions of the trap shrug, which still target the trapezius and medial deltoid, use cables or resistance bands and can be easier on the neck and biceps. Cables also allow you to adapt the movement to suit your needs.

BANDED UPRIGHT ROW

This variation uses a resistance band to train the upper traps and muscles of the shoulders. For added challenge, hold for 1–2 seconds at the top position.

PREPARATORY STAGE

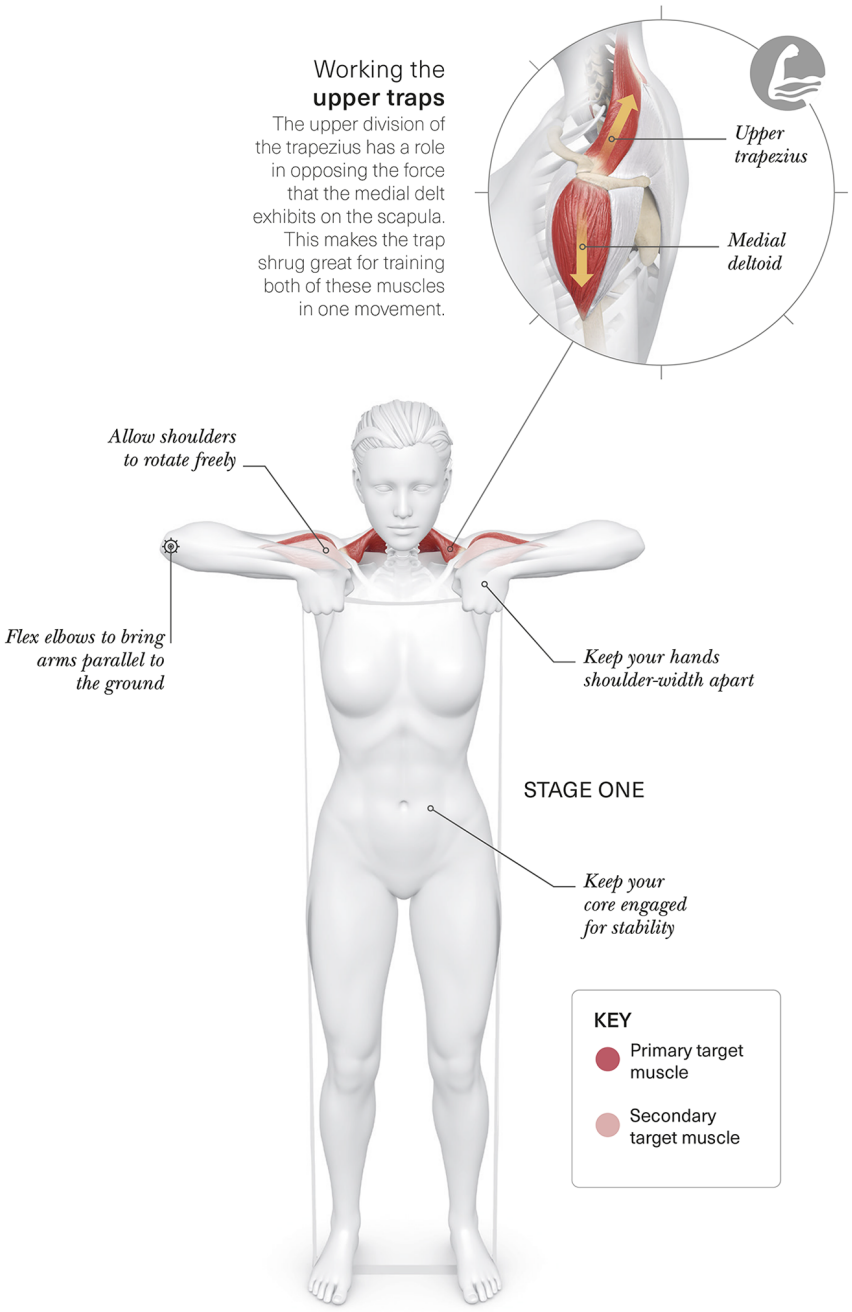
Place the resistance band beneath your feet and hold it with a pronated grip, hands shoulder-width apart. Stand tall with your shoulders relaxed.



ℹ Double-tap image to read the labels

STAGE ONE

Breathe in to engage your core, then breathe out as you row up, lifting your shoulders and bringing your hands upward as you flex your elbows.



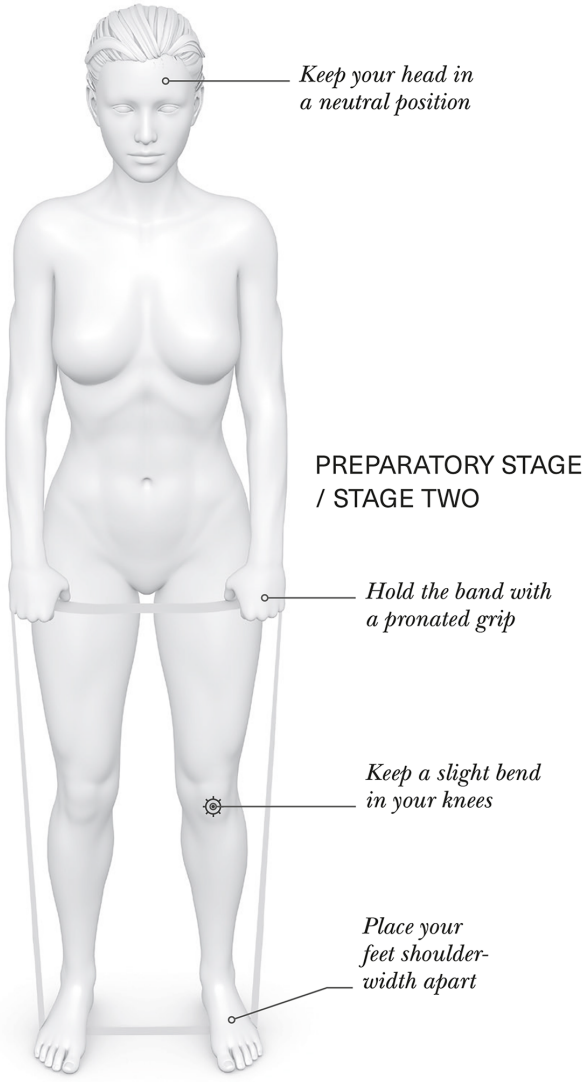
Double-tap image to read the labels

Working the **upper traps**

The upper division of the trapezius has a role in opposing the force that the medial delt exhibits on the scapula. This makes the trap shrug great for training both of these muscles in one movement.

STAGE 2

Breathe in as you lower your shoulders and extend your arms back to your starting position, with control. Repeat stages 1 and 2.



ℹ Double-tap image to read the labels

CABLE UPRIGHT ROW

This cable-based varation trains the upper traps and the muscles of the shoulders. The cables keep tension on your shoulders. Hold the cable at chin height for 1–2 seconds for a more intense workout.

PREPARATORY STAGE

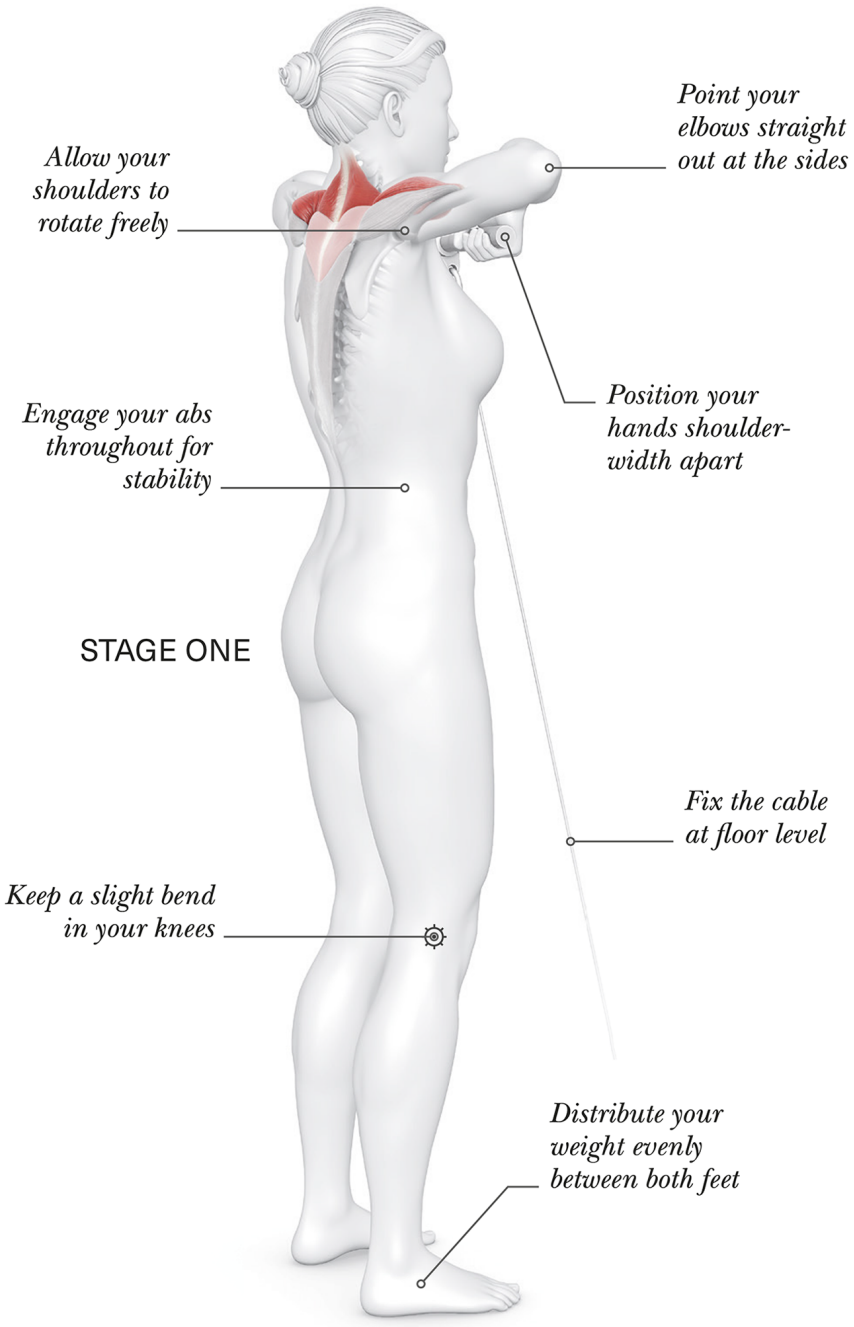
Stand tall with your feet shoulder-width apart and a slight bend in your knees. Hold the cable handle with both hands in a pronated grip.

STAGE ONE

Breathe in and engage your abs, then breathe out to row the cable up to chin height, flexing your elbows outward to bring your arms parallel with the floor.

STAGE TWO

Breathe in as you lower the cable, with control, back to the starting position. Keep tension in your shoulders throughout. Repeat stages 1 and 2.



Double-tap image to read the labels

CABLE TRAP SHRUG

This variation, using bilateral cables, is ideal for training the upper traps, the muscle fibres of which line up well with the line of resistance formed by the cable. For added challenge, hold at the top position for 1–2 seconds.

PREPARATORY STAGE

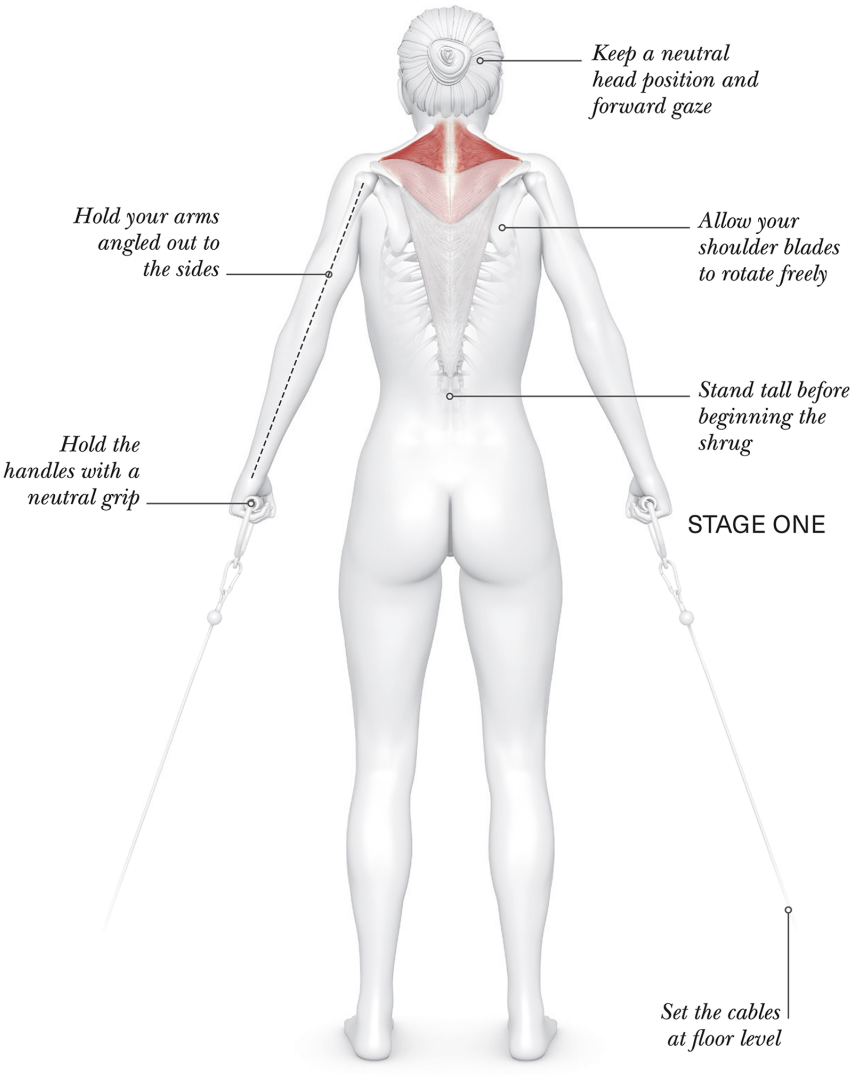
Stand with your feet shoulder-width apart and a slight bend in your knees. Bend over to grasp the cable handles, then stand up straight.

STAGE ONE

Breathe in and engage your core. Breathe out as you shrug your shoulders up and in toward your ears, without rolling them forward or back.

STAGE TWO

Breathe in as you lower your shoulders back to the starting position, keeping your core and traps engaged for control. Repeat stages 1 and 2.



Double-tap image to read the labels

SHOULDER EXERCISES

The main role of the deltoids (or delts) in training is to help raise or extend your arms; there are three primary divisions of the deltoid. The front (anterior) delt enables flexion, raising your arm up in front of your body; the medial (lateral) delt enables abduction, raising your arm away from your body; and the rear (posterior) delt enables extension, rotating your arm behind you.

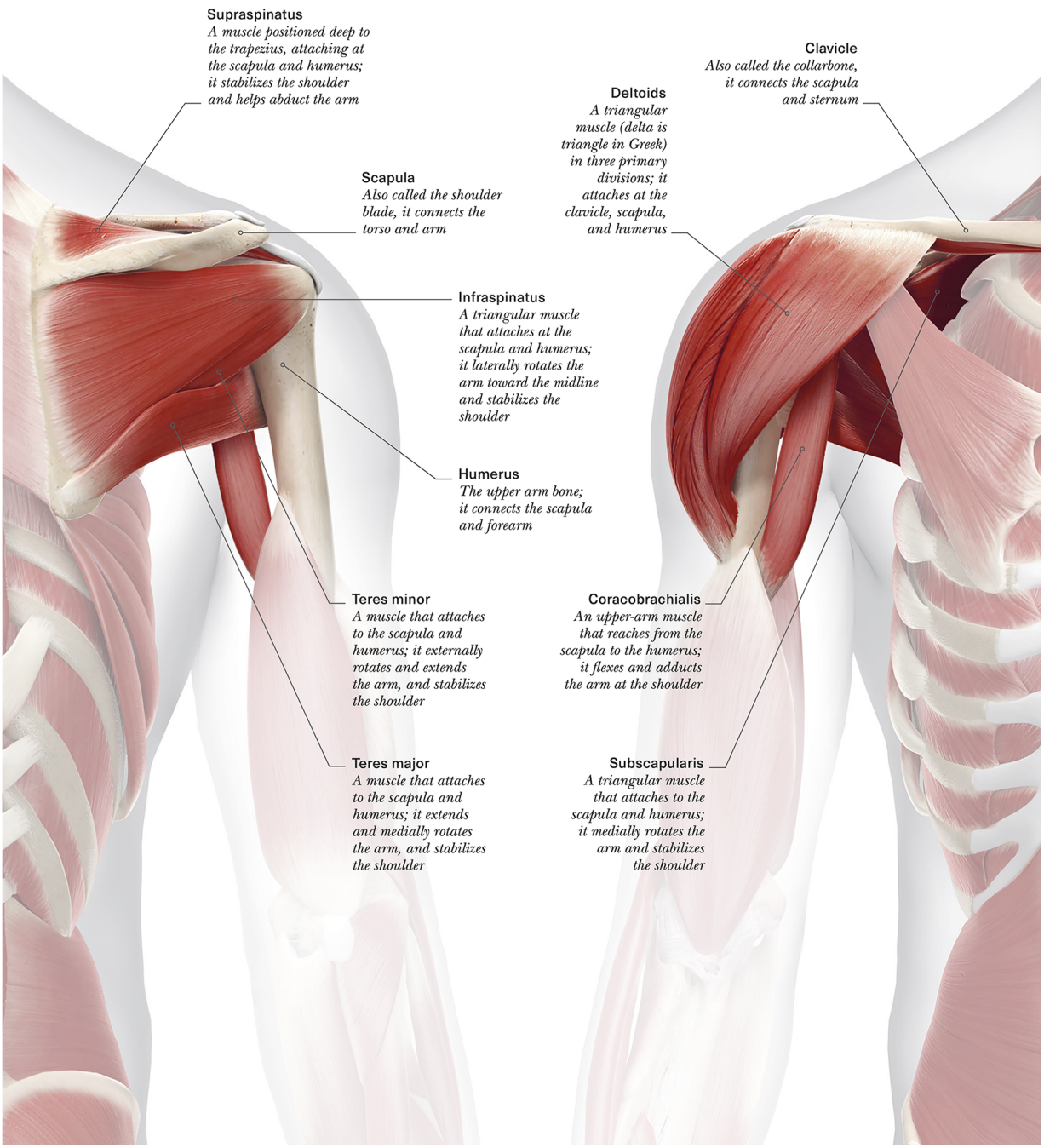
The main muscle responsible for moving the shoulders is the deltoid, the muscle that wraps around the shoulder, front to back, and gives the shoulders much of their shape. Other muscles are key for stabilizing the shoulder joint, including teres major, teres minor, supraspinatus, and subscapularis.

You use delts repetitively in your day-to-day life and in training, so it's key to train them via different loading methods and rep counts.

When pressing, the shoulders integrate with the triceps and muscles of the upper back to help in driving the weight up as the deltoid brings the arm closer to the midline.

When raising, the shoulders work almost in isolation, with some assistance from the traps. Don't just think about getting the resistance to a certain destination: remember the function and anatomy of the portion of the deltoid you want to target, and move appropriately through the full range of motion.

Use pressing and raising movements to target the front and middle deltoids, and rowing and flying to work the rear delts.



Double-tap image to read the labels

POSTERIOR VIEW

Supraspinatus

A muscle positioned deep to the trapezius, attaching at the scapula and humerus; it stabilizes the shoulder and helps abduct the arm

Scapula
Also called the shoulder blade, it connects the torso and arm

Infraspinatus
A triangular muscle that attaches at the scapula and humerus; it laterally rotates the arm toward the midline and stabilizes the shoulder

Humerus
The upper arm bone; it connects the scapula and forearm

Teres minor
A muscle that attaches to the scapula and humerus; it externally rotates and extends the arm, and stabilizes the shoulder

Teres major
A muscle that attaches to the scapula and humerus; it extends and medially rotates the arm, and stabilizes the shoulder

ANTERIOR VIEW

Clavicle
Also called the collarbone, it connects the scapula and sternum

Subscapularis
A triangular muscle that attaches to the scapula and humerus; it medially rotates the arm and stabilizes the shoulder

Deltoids
A triangular muscle (delta is triangle in Greek) in three primary divisions; it attaches at the clavicle, scapula, and humerus

Coracobrachialis
An upper-arm muscle that reaches from the scapula to the humerus; it flexes and adducts the arm at the shoulder

"Having a strong upper body ***improves posture, mobility, flexibility****, and* ***range of motion****."*

SECTION CONTENTS

Barbell overhead shoulder press

Variations:

- Machine shoulder press
- Banded shoulder press
- Dumbbell shoulder press

Dumbbell lateral raise

Variations:

- Banded lateral raise
- Unilateral cable lateral raise

Dumbbell front raise

Variations:

- Banded front raise
- Cable front raise
- Front deltoid shoulder press

Dumbbell rear deltoid fly

Variations:

- Machine rear deltoid fly
- Prone bench rear deltoid raise
- Banded deltoid row

BARBELL OVERHEAD **SHOULDER PRESS**

This dominant vertical pressing movement trains the muscles of the shoulders and the triceps, while also targeting the upper back and challenging core stability. The overhead press can be performed seated or standing; keep the barbell even and the movements controlled.

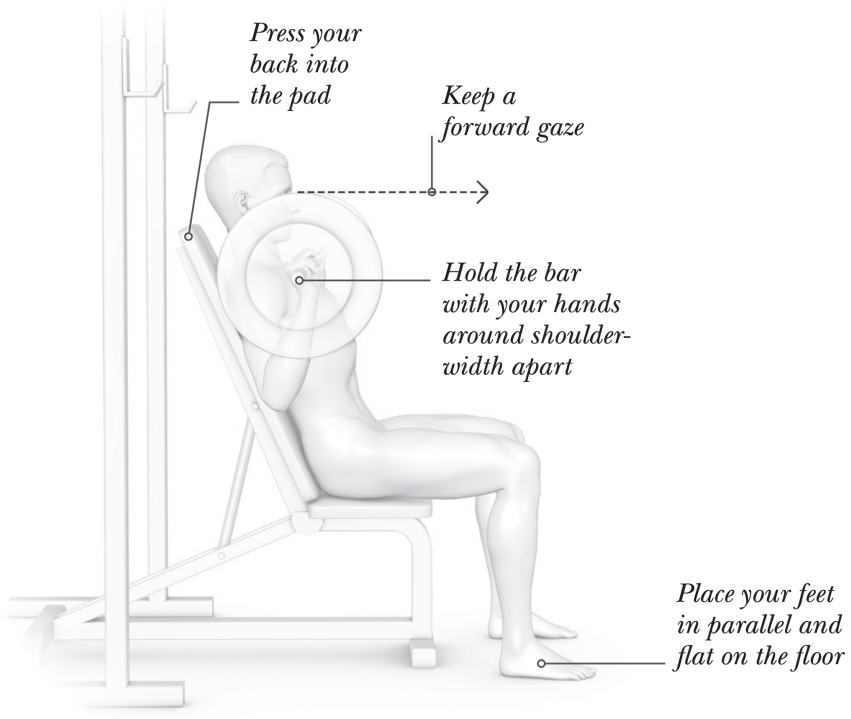
THE **BIG PICTURE**

Your knees should be bent at 90° for this seated shoulder press, so adjust the seat height of the machine accordingly. Most machines set the bar just above and behind your head so you can easily reach and then lift the bar off to bring it into position. If you experience any joint discomfort, try switching to the dumbbell variation.

Beginners can start with 4 sets of 8–10 reps; discover other variations on and other targeted sets in the training programmes.

PREPARATORY STAGE

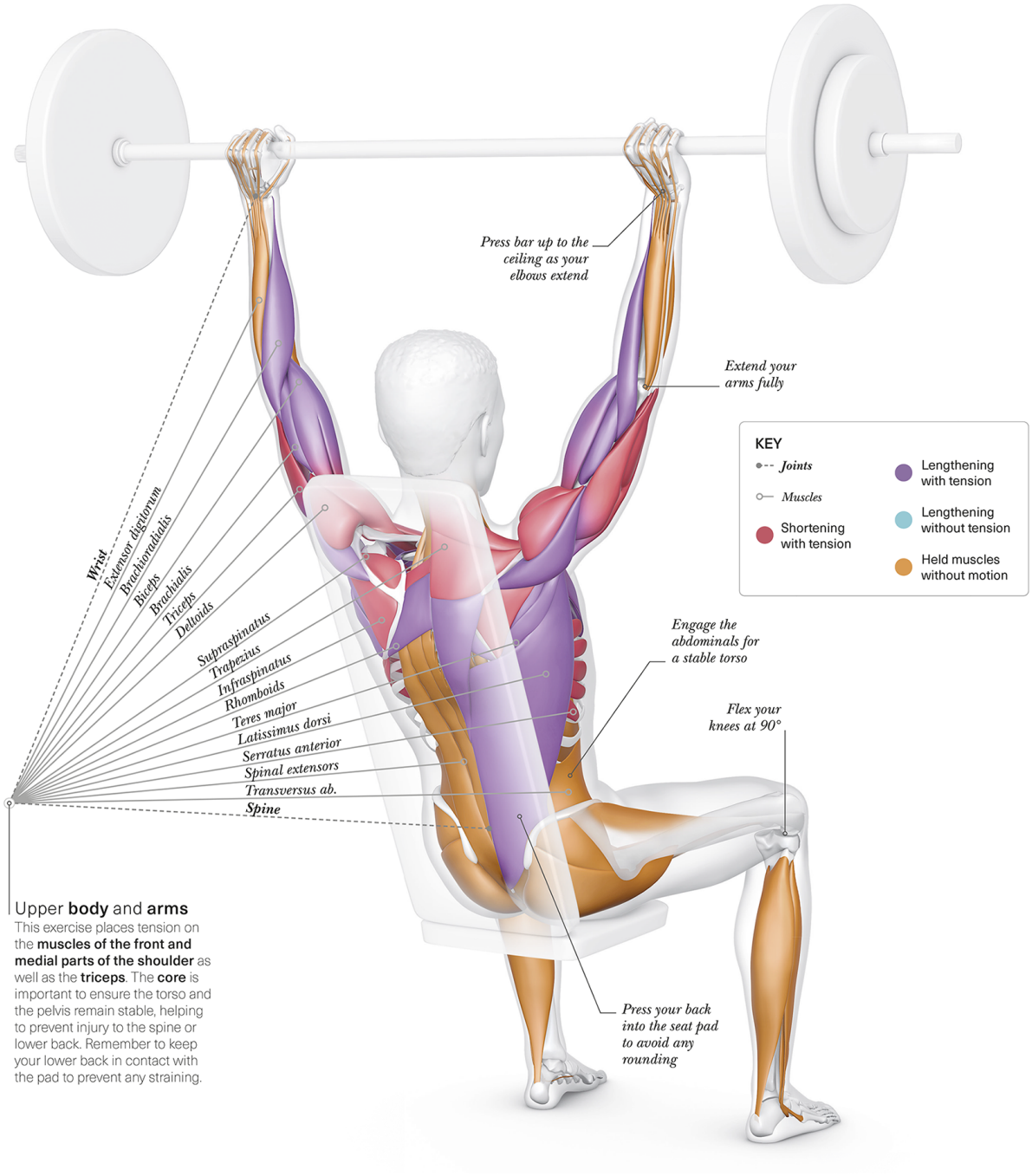
Set up the machine and sit with your back on the pad, knees bent and feet shoulder-width apart. Keep your head in a neutral position. Rest the barbell under your chin and against your chest using a thumb-over grip. Engage your glutes and core to help stabilize your upper body.



Double-tap image to read the labels

STAGE ONE

Take a breath in and activate muscles of the upper back, as well as glutes and core. Tuck in your chin to avoid the bar hitting your face and to maintain a neutral head position and a neutral spine. Breathe out as you press the barbell smoothly straight up above your head, extending your arms at the elbows.



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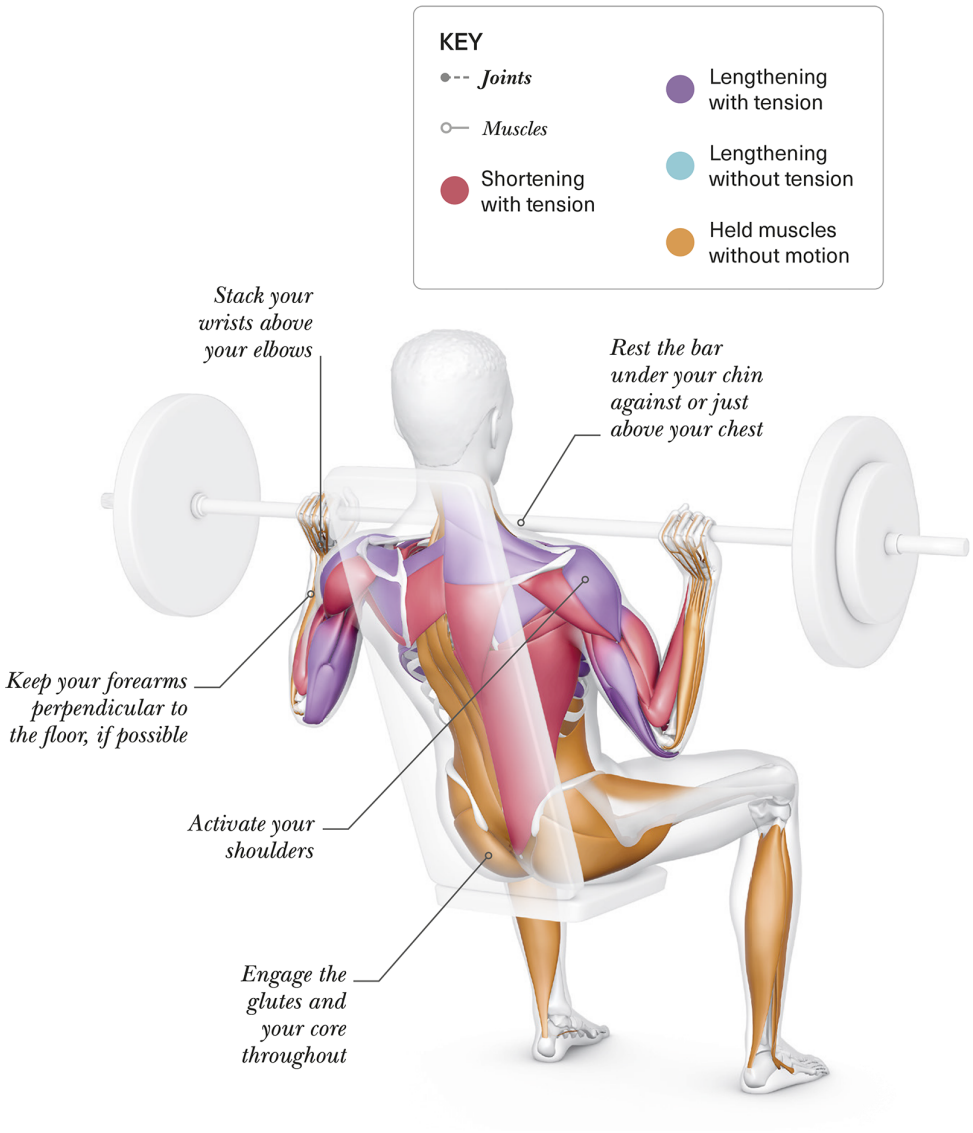
POSTERIOR-LATERAL VIEW

Upper **body** and **arms**

This exercise places tension on the **muscles of the front and medial parts of the shoulder** as well as the **triceps**. The **core** is important to ensure the torso and the pelvis remain stable, helping to prevent injury to the spine or lower back. Remember to keep your lower back in contact with the pad to prevent any straining.

STAGE TWO

Breathe in as you place tension through your shoulders and triceps to flex at your elbows and resist the weight of the bar, lowering it back to the starting position. Your shoulders should be stable but not pinned down, and your spine and head positions should remain neutral. Reset your breathing and repeat stages 1 and 2.



Double-tap image to read the labels

Common mistakes

Arching at the back is a common error. When you press up, do not compensate for the weight of the bar by rounding your spine; press against the back pad and keep your back neutral throughout.

VARIATIONS

Target the delts and triceps while performing an overhead press on various pieces of equipment; standing versions will work your core harder. All three exercises here reduce strain on the shoulders, as the shoulder blades can freely rotate.

MACHINE SHOULDER PRESS

This machine-based variation is great for adding variety to your shoulder training; it works well as either a stand-alone exercise or part of a combination. The machine offers a safe and effective environment for vertical pressing.

PREPARATORY STAGE

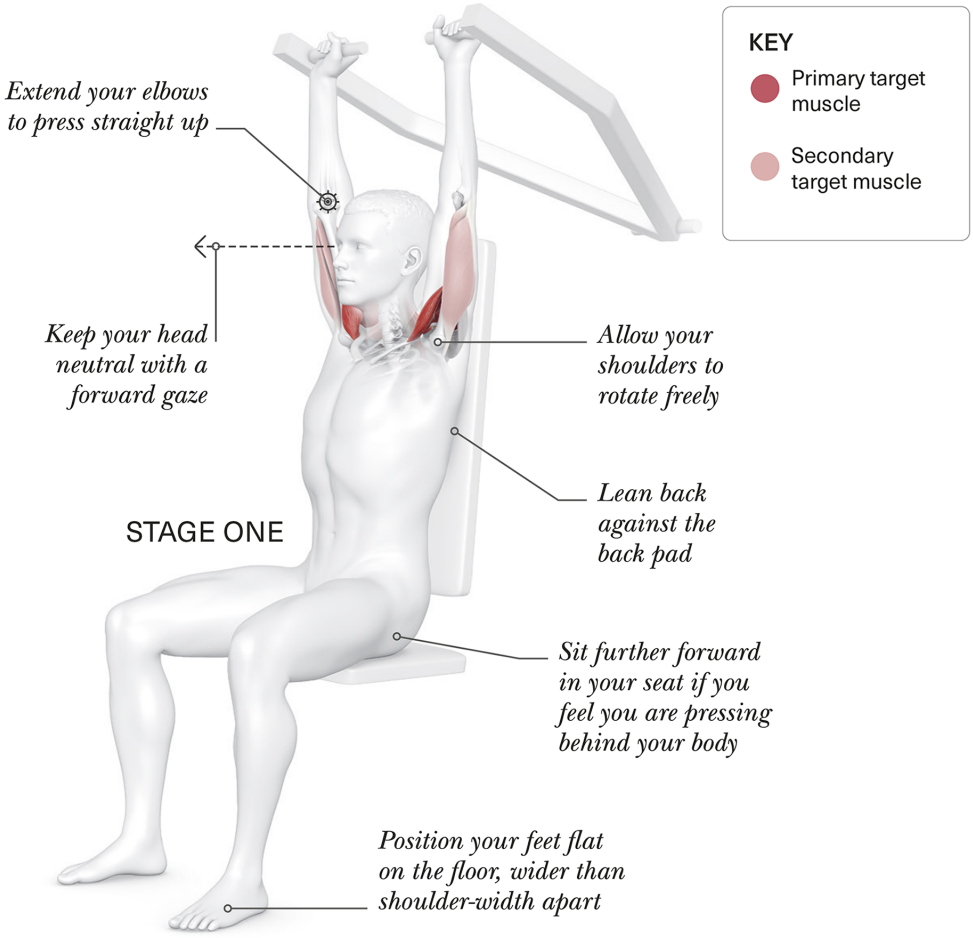
Sit in position (adjust the seat height if needed) and grasp the attachment handles, with your elbows flexed out to the sides and hands in a pronated grip.

STAGE ONE

Inhale to engage your core, then exhale as you extend your elbows to drive your arms upward, focussing on driving your upper arms toward your ears.

STAGE TWO

Breathe in to lower your arms, maintaining control, to return the attachment to its starting point. Adjust your position if needed. Repeat stages 1 and 2.



Double-tap image to read the labels

BANDED SHOULDER PRESS

This resistance-band-based variation trains the vertical press, while allowing for more individualization based on shoulder mobility and preference. Your arm path as you drive up will depend on your shoulder mobility.

PREPARATORY STAGE

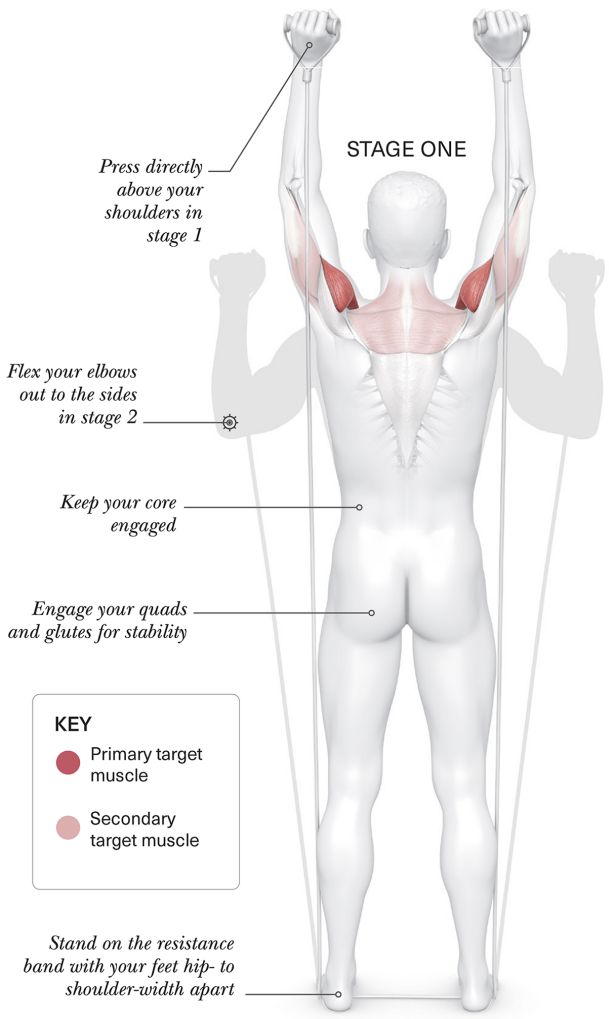
Place the resistance band beneath your feet and grasp the handles in a pronated grip. Stand tall, with your arms flexed and hands at ear height.

STAGE ONE

Breathe in to engage your abs, then breathe out to drive your arms up, pressing your upper arms in toward your ears.

STAGE TWO

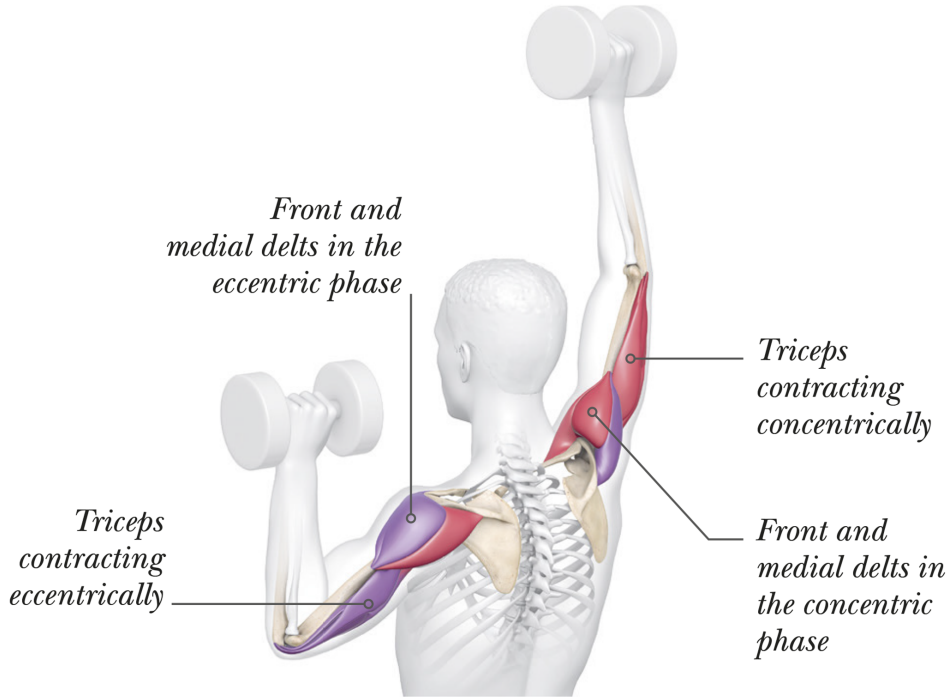
Breathe in as you lower your arms, with control, flexing your elbows to lower your hands to their starting position. Repeat stages 1 and 2.



Double-tap image to read the labels

Combining forces

Muscles work in synchronicity with one another. As you can see, in vertical pressing, the triceps works together with the front and medial deltoids to drive the dumbbells up and in.



Double-tap image to read the labels

DUMBBELL SHOULDER PRESS

This is another useful variation for customization based on shoulder mobility – which will determine the angle of the dumbbells and your arm path – and preference. It also provides greater core engagement and reduces pressure on the shoulders.

PICKING UP THE WEIGHTS SAFELY

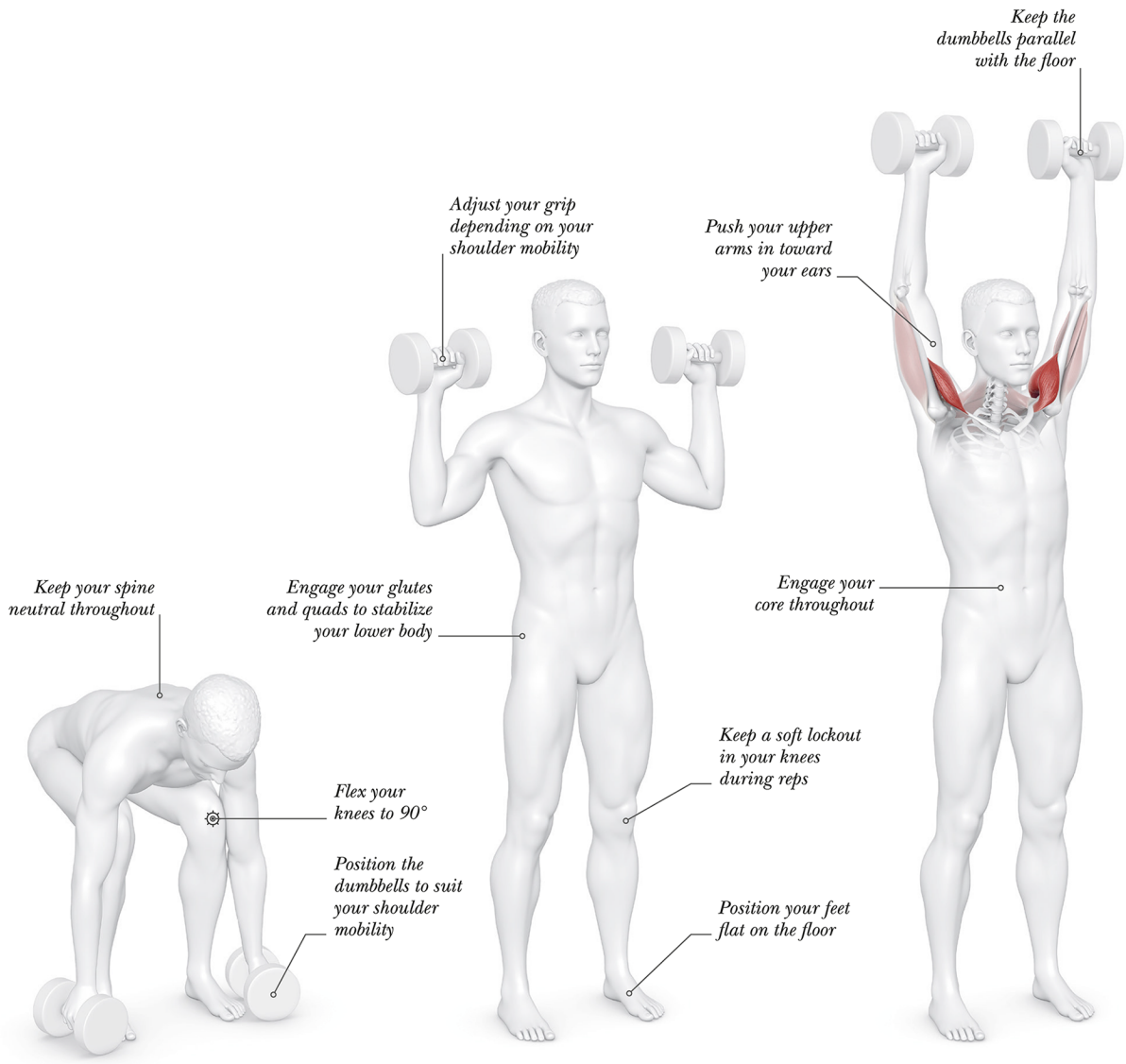
Stand with your feet hip- to shoulder-width apart and flex at the knees and hips to reach the dumbbells, which should be at either side of your feet.

PREPARATORY STAGE / STAGE TWO

Straighten your knees and raise the dumbbells to above shoulder height, with your elbows flexed. Keep your core engaged as you prepare to press up.

STAGE ONE

Breathe in to brace your abdominals, then breathe out as you drive the dumbbells upward. Breathe in to return to stage 2. Repeat stages 1 and 2.



Double-tap image to read the labels

DUMBBELL LATERAL RAISE

The middle part of the deltoid muscle is the focus of this exercise, along with the supraspinatus and the upper part of the trapezius, which stabilize your shoulder blades. The lateral raise is a safe and effective way to train your shoulders using minimal equipment.

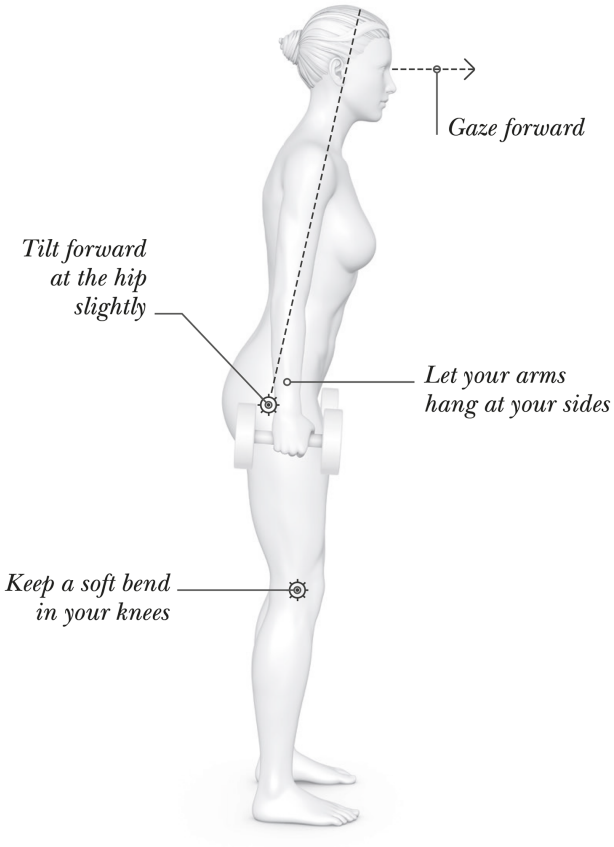
THE BIG PICTURE

Raising and lowering dumbbells laterally – out to the sides of your body – isolates and trains the medial division of the deltoid. Keep the movement smooth and controlled at all times; don't throw the weights up and let them fall down.

Beginners can start with 4 sets of 8–10 reps; discover other variations on and other targeted sets in the training programmes.

PREPARATORY STAGE

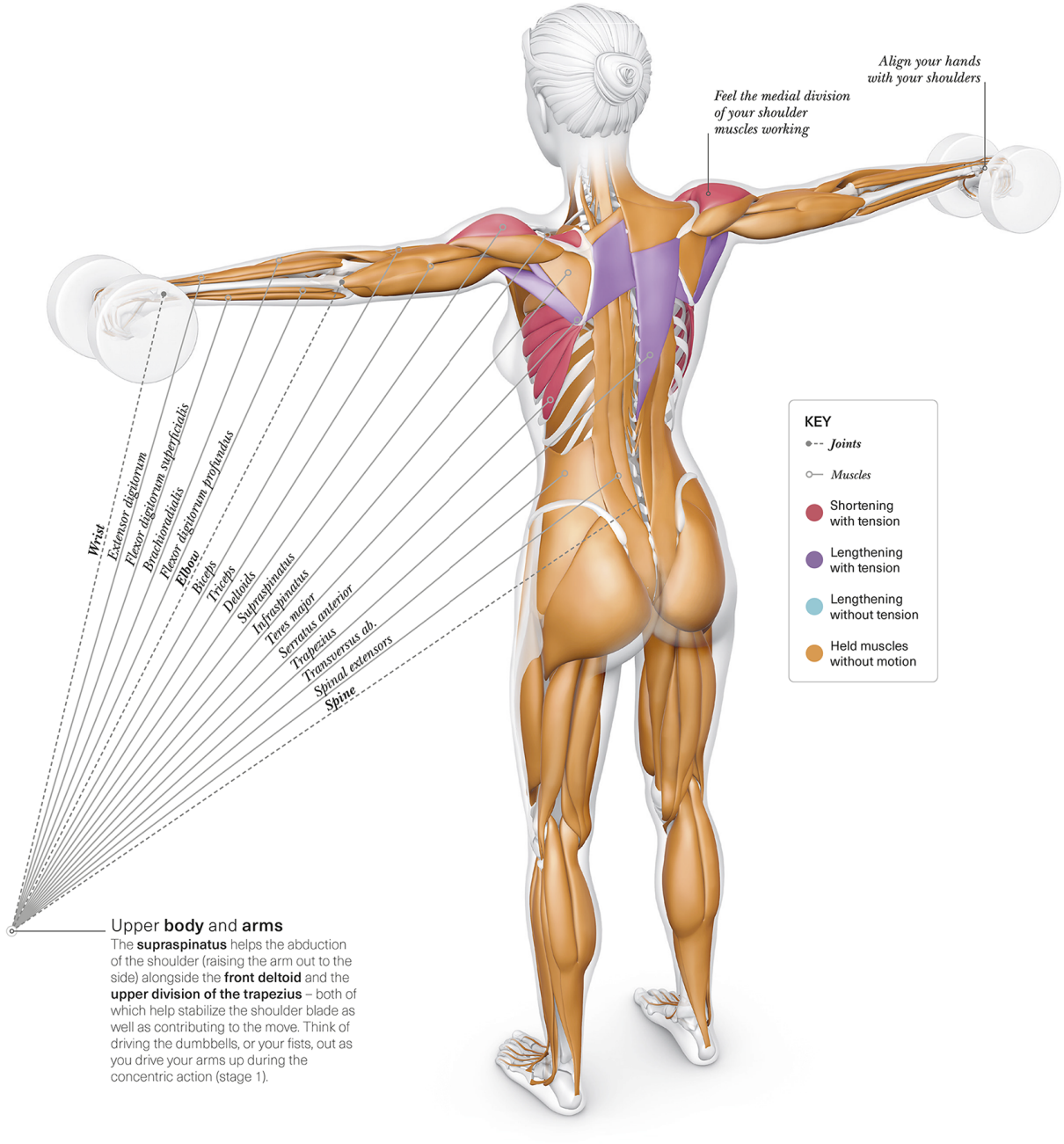
Stand with your feet parallel and shoulder-width apart. Let your arms hang naturally with the dumbbells securely in your hands. Depending on your structure, you may need to rotate the dumbbells inward slightly, to better match up with the middle of your delts.



Double-tap image to read the labels

STAGE ONE

Breathe in and engage your abs to stabilize and tighten your core. Breathe out as you use your deltoid muscles to raise the dumbbells away from your body. Stop when your arms are parallel with the floor. To add challenge, hold this top position for 1 second.



Double-tap image to read the labels

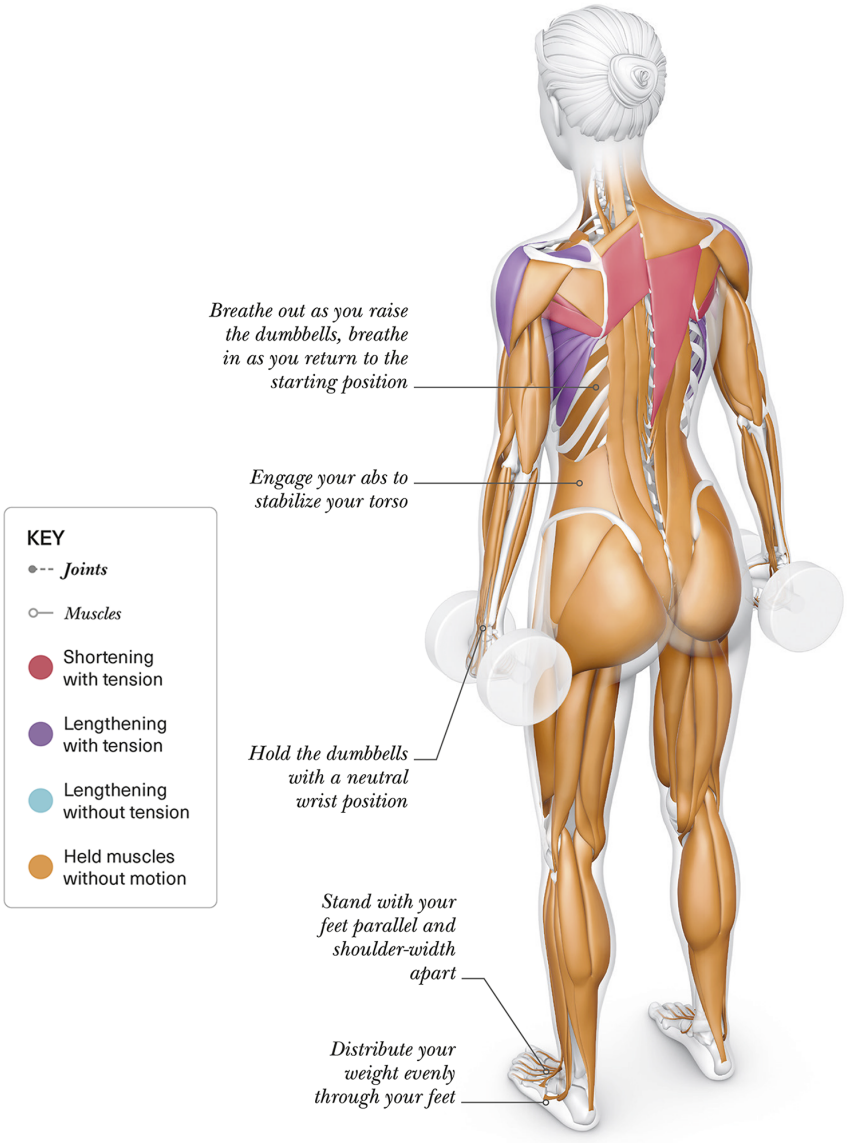
POSTERIOR-LATERAL VIEW

Upper **body** and **arms**

The **supraspinatus** helps the abduction of the shoulder (raising the arm out to the side) alongside the **front deltoid** and the **upper division of the trapezius** – both of which help stabilize the shoulder blade as well as contributing to the move. Think of driving the dumbbells, or your fists, out as you drive your arms up during the concentric action (stage 1).

STAGE TWO

Keeping tension in your shoulders, breathe in as you lower your arms with control, resisting the load. Pause for 1 second in this bottom position to help reduce momentum going into your next rep, and to reset your breathing. Repeat stages 1 and 2.



Double-tap image to read the labels

Common mistakes

If you are moving your lower body and bending your knees, you could be lifting too heavy a weight. And avoid lowering the weights quickly, without control: you miss out on the powerful eccentric contraction.

VARIATIONS

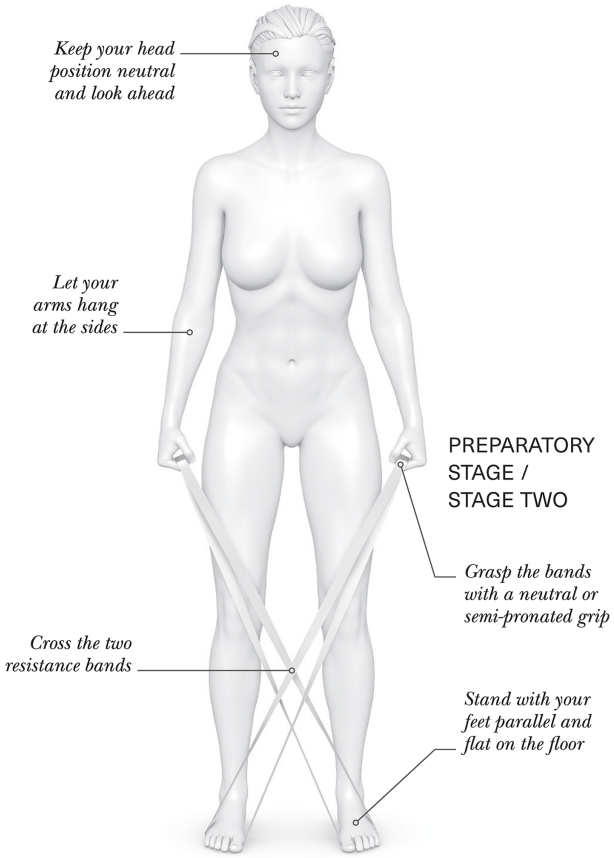
Using bands or cables helps to vary the resistance demands of these exercises that target the delts. The tension in the bands will increase as you go through the rep, while the cable will provide fairly even resistance, increasing toward the top of the movement.

BANDED LATERAL RAISE

In this variation, the resistance provided by the bands increases as you approach the top position. Your stance width also affects the difficulty of the exercise: the wider apart your feet, the more resistance there is from the band.

PREPARATORY STAGE

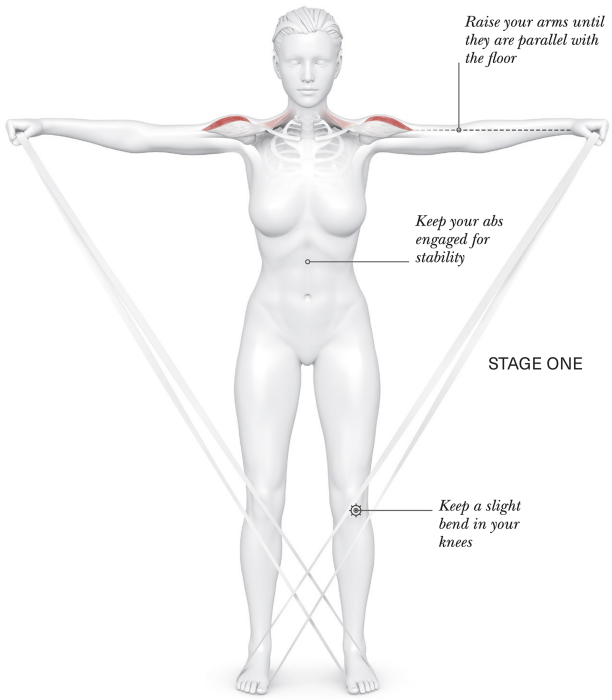
Place a band beneath each foot and hold them with opposite hands. Lean your torso forward slightly to line up the delt with the line of resistance.



ℹ Double-tap image to read the labels

STAGE ONE

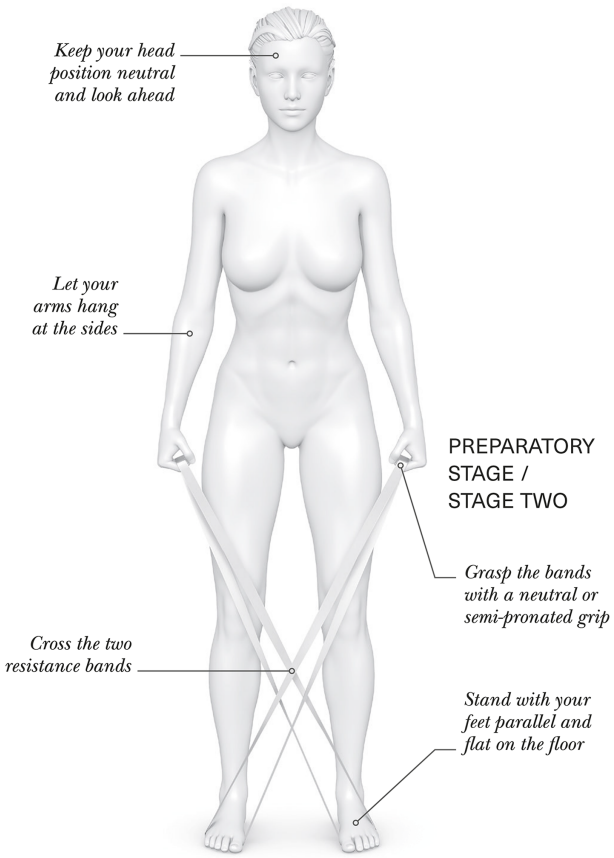
Inhale to brace your core. Breathe out as you raise your arms to shoulder-height, keeping your elbows extended. For added challenge, hold for 1–2 seconds.



Double-tap image to read the labels

STAGE TWO

Breathe in while lowering your arms, ensuring the movement is controlled. Return your arms to your sides, elbows extended. Repeat stages 1 and 2.



ℹ Double-tap image to read the labels

*"These exercises are a great way to **better isolate** tension on **the deltoids.**"*

UNILATERAL CABLE LATERAL RAISE

The cable pulley used in this variation provides continuous resistance during the raise. This exercise also allows you to work each side of the body in isolation, allowing for more variety within your shoulder training.

PREPARATORY STAGE

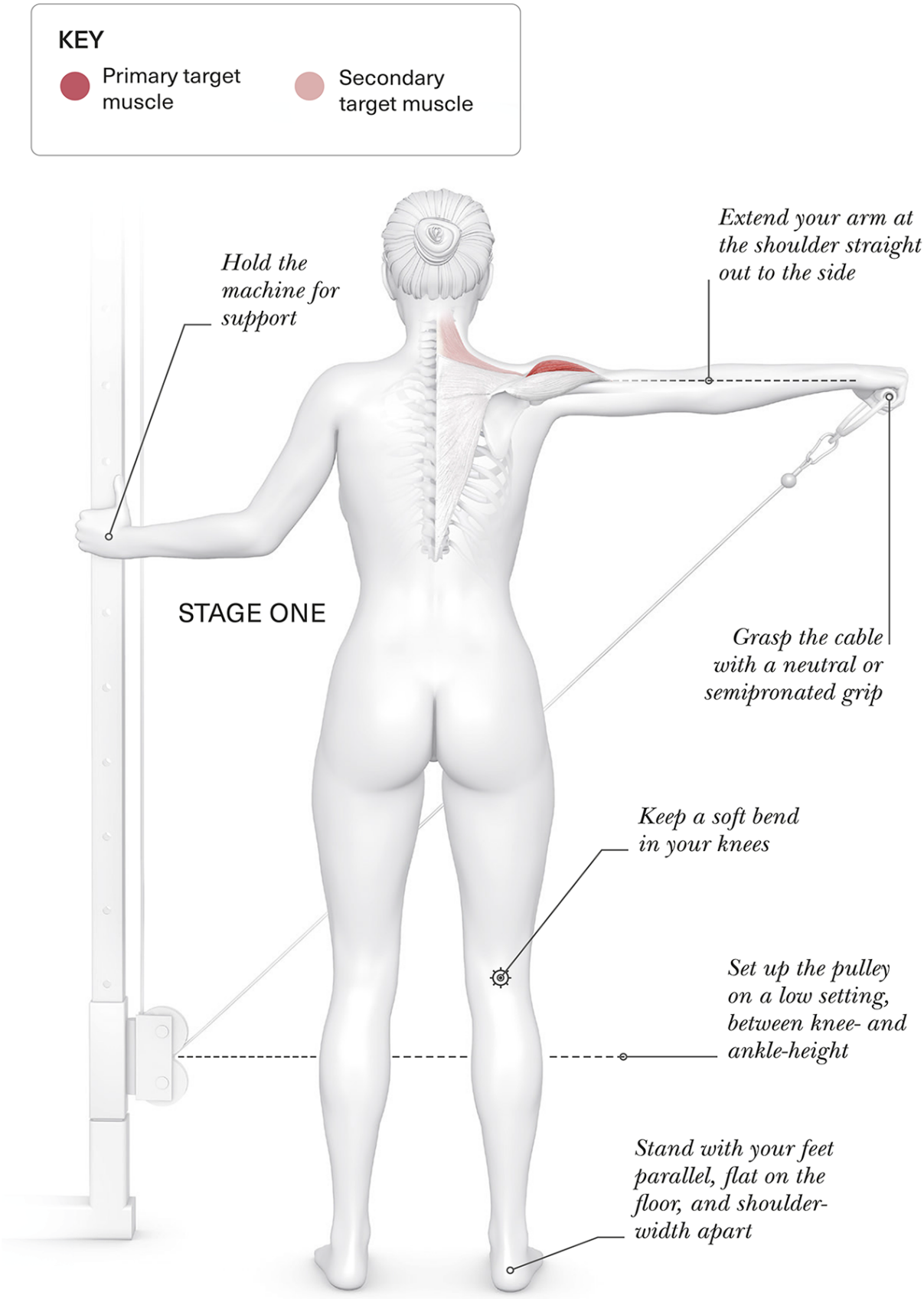
Stand tall, leaning your torso forward slightly to help line up the division of your delt with the line of resistance. Hold the cable with your arm at your side.

STAGE ONE

Inhale to engage your core, then breathe out as you raise your arm to shoulder level, keeping your elbow extended. For added challenge, hold for 1–2 seconds.

STAGE TWO

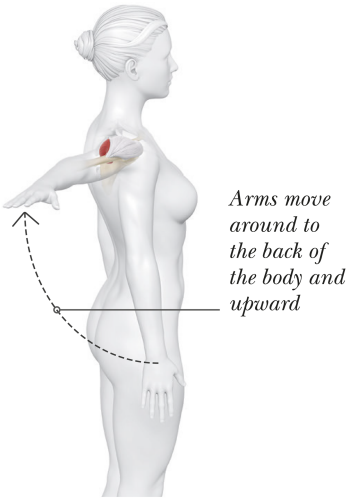
Breathe in as you lower your arm, keeping tension in your shoulders to control the movement. Repeat stages 1 and 2.


KEY
Primary target muscle
Secondary target muscle
Hold the machine for support
Extend your arm at the shoulder straight out to the side
STAGE ONE
Grasp the cable with a neutral or semipronated grip
Keep a soft bend in your knees
Set up the pulley on a low setting, between knee- and ankle-height
Stand with your feet parallel, flat on the floor, and shoulder-width apart

Double-tap image to read the labels

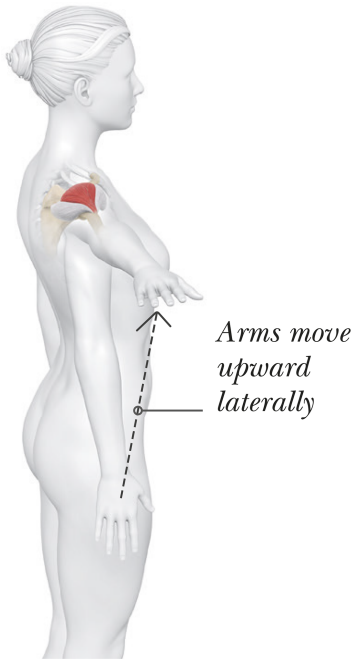
Targeting divisions of the **deltoids**

Each division of the delts – anterior (front), medial (side), and posterior (rear) – performs different muscle actions and has a different line of pull. Because of this, it is important that you choose exercises that best challenge the role of each specific division of the deltoid. Pressing and pulling exercises tend to have good overlap with the front and rear delt muscles. The medial delt needs to be isolated the most with exercises such as the lateral raise.



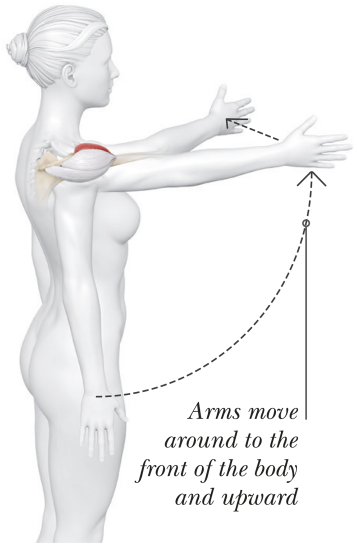
Double-tap image to read the labels

POSTERIOR DELTOID



Double-tap image to read the labels

MEDIAL DELTOID



Double-tap image to read the labels

ANTERIOR DELTOID

DUMBBELL FRONT RAISE

The front (anterior) part of the deltoid muscle is the principle focus of this exercise. As with the lateral raise, you can also perform this movement using cables or resistance bands.

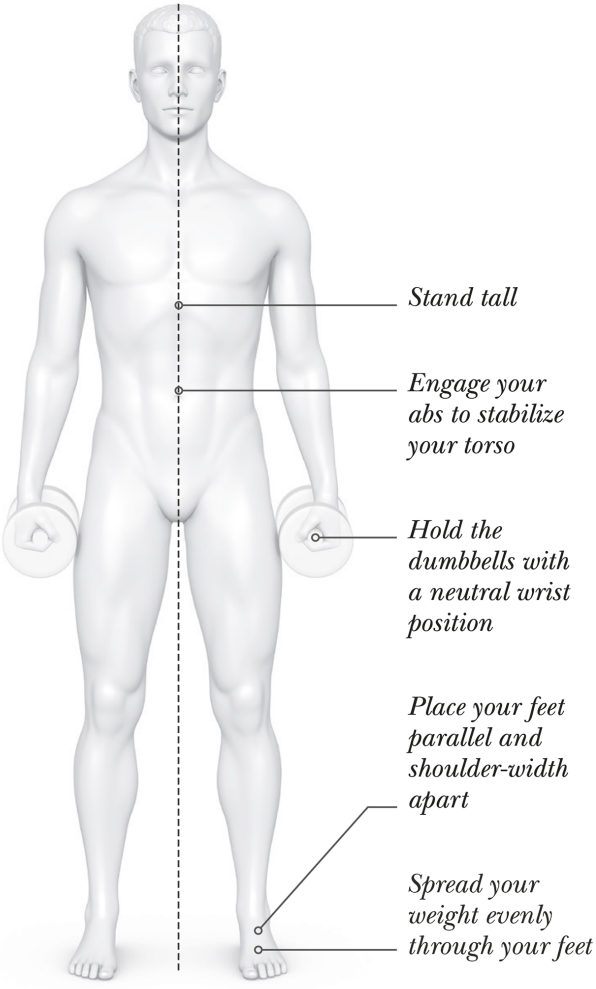
THE BIG PICTURE

Raising and lowering dumbbells directly in front of your body targets the front division of the deltoid. Ensure a smooth, controlled movement throughout; don't throw the weights up and let them fall down. Your arms will naturally move slightly inward as you raise, to best align with the inward pull of the front delts. If you experience any shoulder discomfort during this exercise, try switching to the cable or the resistance-band variation (overleaf).

Beginners can start with 4 sets of 8–10 reps; discover other variations on and other targeted sets in the training programmes.

PREPARATORY STAGE

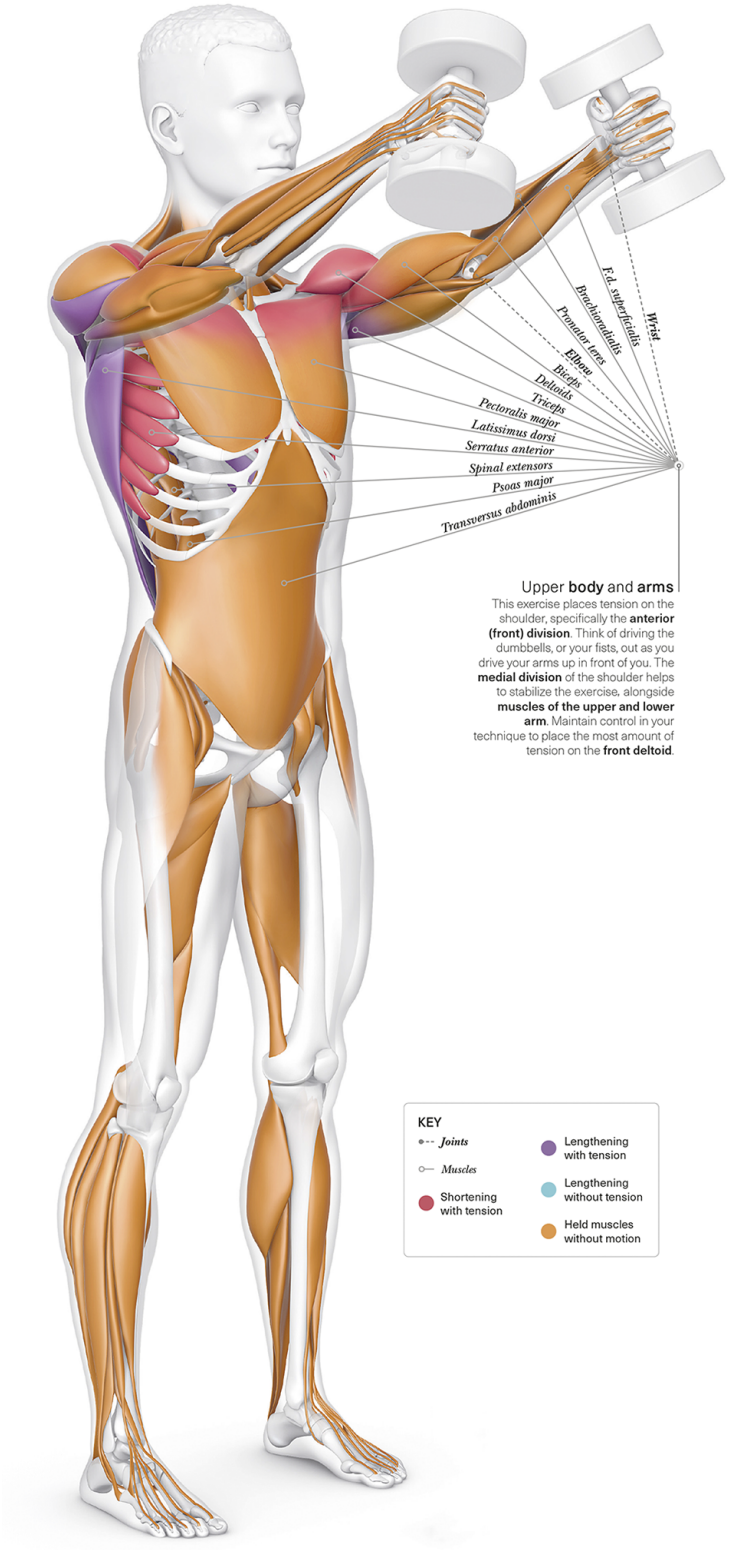
Stand with your feet parallel and shoulder-width apart. Let your arms hang naturally at the side of your body with the dumbbells securely in your hands. Ensure that you head position is neutral.



ⓘ Double-tap image to read the labels

STAGE ONE

Breathe in and engage your core. Exhale and, using your front deltoids, flex at the shoulders to raise the dumbbells directly in front of you. Stop when your arms are at or just above parallel to the floor. To add challenge, hold for 1 second.



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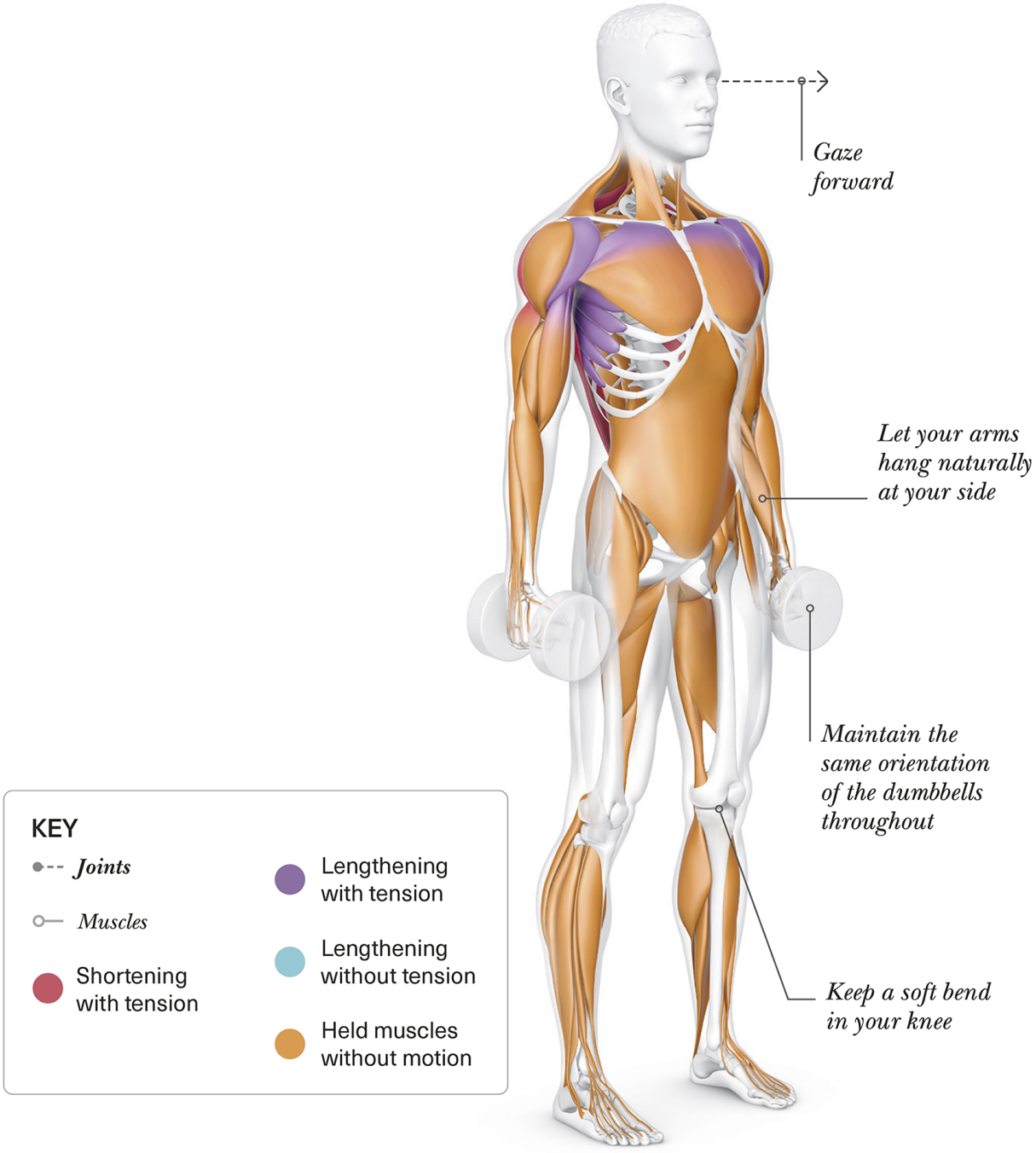
ANTERIOR-LATERAL VIEW

Upper **body** and **arms**

This exercise places tension on the shoulder, specifically the **anterior (front) division** (see Banded Front Raise). Think of driving the dumbbells, or your fists, out as you drive your arms up in front of you. The **medial division** of the shoulder helps to stabilize the exercise, alongside **muscles of the upper and lower arm**. Maintain control in your technique to place the most amount of tension on the **front deltoid**.

STAGE TWO

Keeping tension in your shoulders, breathe in to lower your arms with control, resisting the load. Pause for 1 second here to help reduce momentum going into your next rep, and to reset your breathing. Repeat stages 1 and 2.



Double-tap image to read the labels

Common mistakes

Lift the weights too high and you will shift the muscle target to the upper trapezius; too low, and you won't get a powerful enough contraction on the front deltoid. Avoid leaning back, too.

VARIATIONS

Variations of the front raise using a resistance band or cables are useful alternatives to the dumbbell version, while a seated shoulder press that targets the anterior (front) deltoids is an effective way to practise the pressing motion. As with the dumbbell front raise, raise and lower your arms with smooth, controlled movements; the cable pulley variation will make this easier to achieve.

BANDED FRONT RAISE

If you experience any shoulder discomfort when practising the dumbbell front raise, this variation using a resistance band could be a useful alternative. For added challenge, hold the top position for 1–2 seconds.

PREPARATORY STAGE

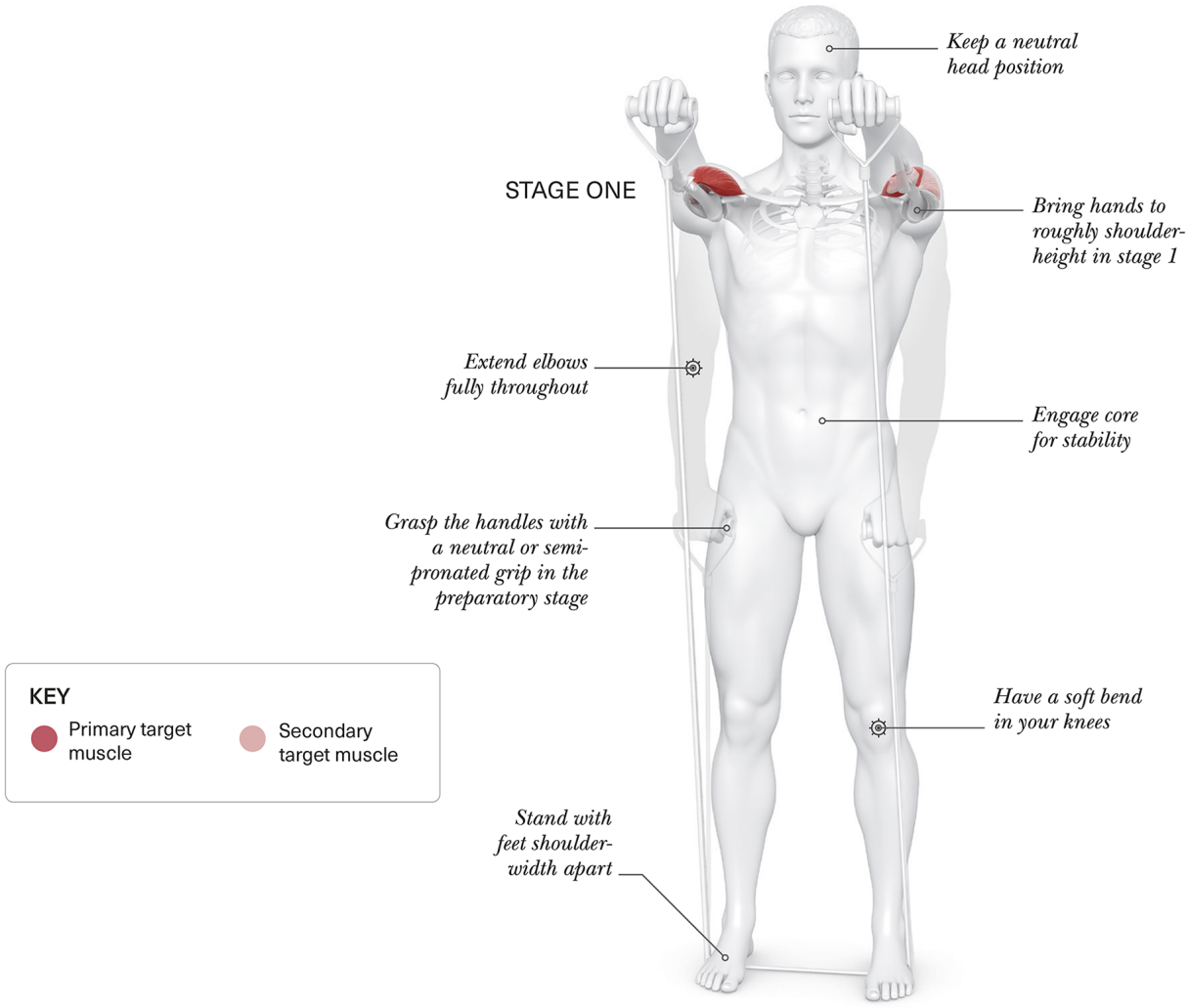
Place the band beneath your feet and take hold of the handles. Stand tall with your arms hanging relaxed at your sides.

STAGE ONE

Breathe in to engage your abs, then breathe out as you raise your arms straight in front of your body while flexing at the shoulders.

STAGE TWO

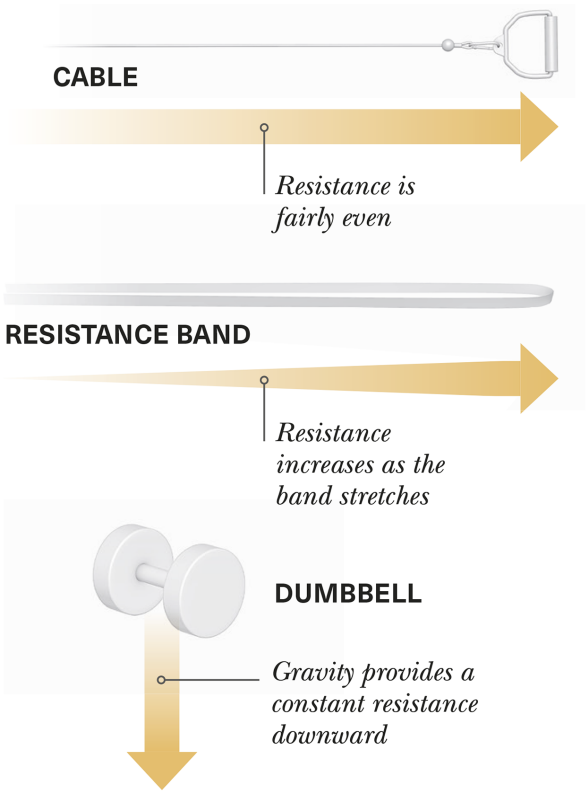
Breathe in to lower your arms to the starting position, maintaining control throughout. Repeat stages 1 and 2.



Double-tap image to read the labels

Differences in **resistance**

Each piece of training equipment challenges muscles differently. Dumbbells are directly impacted by gravity and so place most tension on the muscle at the bottom of the range of motion. Resistance bands gain more tension as they are stretched, reaching peak challenge at the top of the range of movement. Cables provide the most even form of resistance.



Double-tap image to read the labels

CABLE FRONT RAISE

This variation allows for a more continuous, even resistance from the cable pulley, which should line up with the fibres of your front deltoids. To increase the challenge of the exercise, hold at the top position for 1–2 seconds.

PREPARATORY STAGE

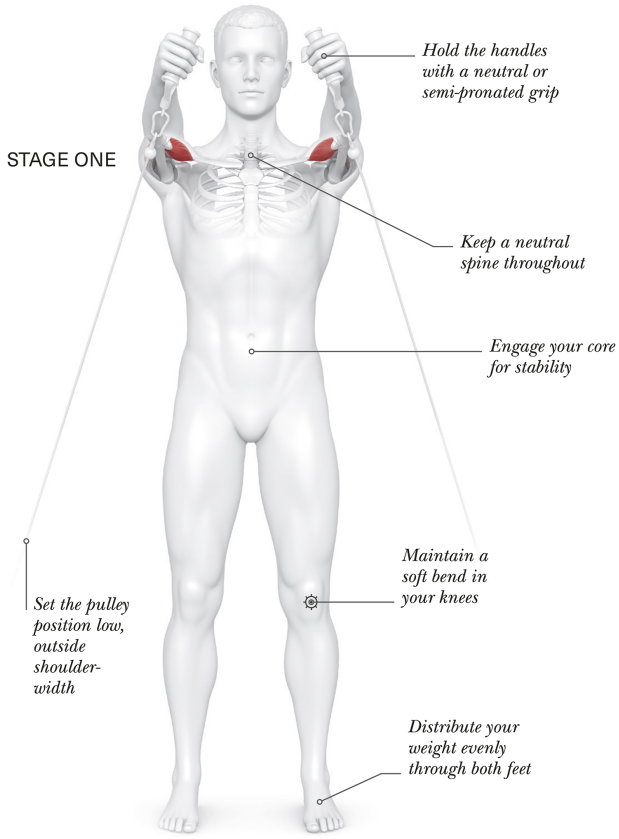
Stand with feet shoulder-width apart; you can also stagger your feet for more stability. Grasp the cable handles and relax your shoulders so your arms hang.

STAGE ONE

Breathe in to brace your core, then breathe out as you raise your arms until your hands are at ear-height, keeping your elbows extended.

STAGE TWO

Breathe in to lower the cables to their starting position, controlling the movement and with straight arms throughout. Repeat stages 1 and 2.



ℹ Double-tap image to read the labels

FRONT DELTOID **SHOULDER PRESS**

This exercise trains the vertical pressing motion, working your triceps and elbow flexors as well as your front delts. This variation is better aligned to the front delt than a standard seated shoulder press.

PREPARATORY STAGE

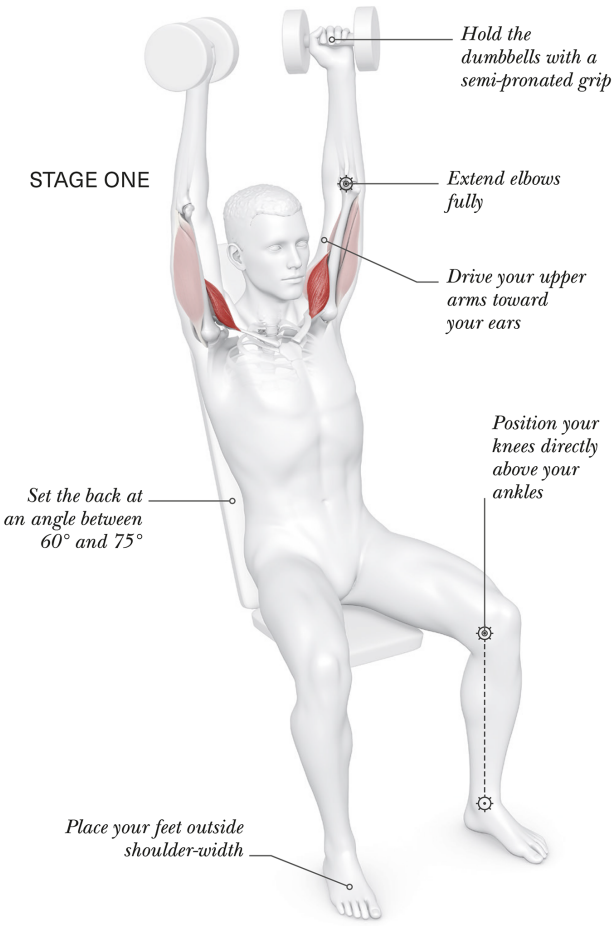
Position yourself on the bench. Take hold of the dumbbells with a semi-pronated grip and hold them just above shoulder-height with your elbows flexed.

STAGE ONE

Breathe in to engage your core. Breathe out as you extend your arms to raise the weights above your head, stacking your wrists above your elbows.

STAGE TWO

Breathe in to lower your arms with control, returning them to the starting position. Repeat stages 1 and 2.



ℹ Double-tap image to read the labels

DUMBBELL REAR DELTOID FLY

This fly exercise trains the rear deltoid muscle while also challenging the muscles of the upper back. As with the front raise, you can also perform this movement with cables or resistance bands.

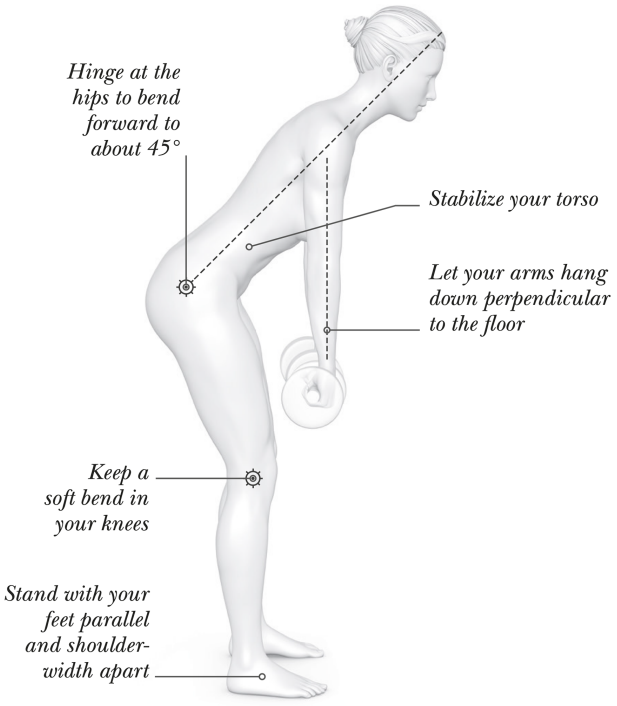
THE BIG PICTURE

Raising and lowering dumbbells from low to high and from the front to the side of your body (in a flying movement) targets the rear division of your deltoid. Move the weights with control, rather than throwing them out and letting them fall back. If you experience any shoulder discomfort, try switching to the cable or the resistance-band variation (overleaf).

Beginners can start with 4 sets of 8–10 reps; discover other variations on and other targeted sets in the training programmes.

PREPARATORY STAGE

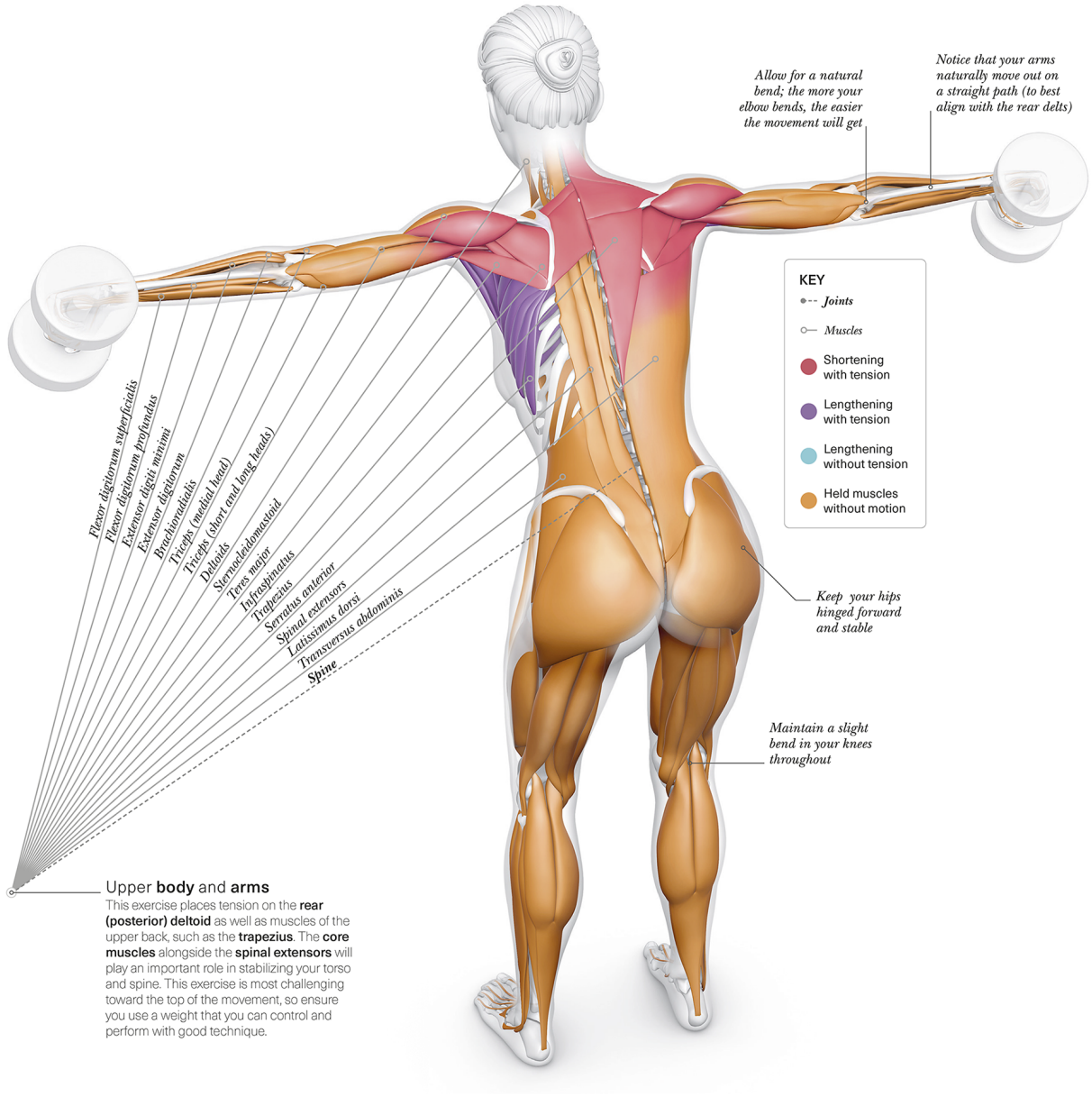
Stand with your feet shoulder-width apart and your torso tilted forward, and let your arms hang naturally in front of your body with the dumbbells securely in your hands. Ensure your head remains in a neutral position.



Double-tap image to read the labels

STAGE ONE

Inhale to engage your abs. Breathe out as you use your rear deltoids and upper-back muscles to fly the dumbbells out to the sides. Start slowly, then accelerate as you move to the top position; stop when your arms are roughly parallel with the floor. To add challenge, hold for 1 second.



Double-tap image to read the labels

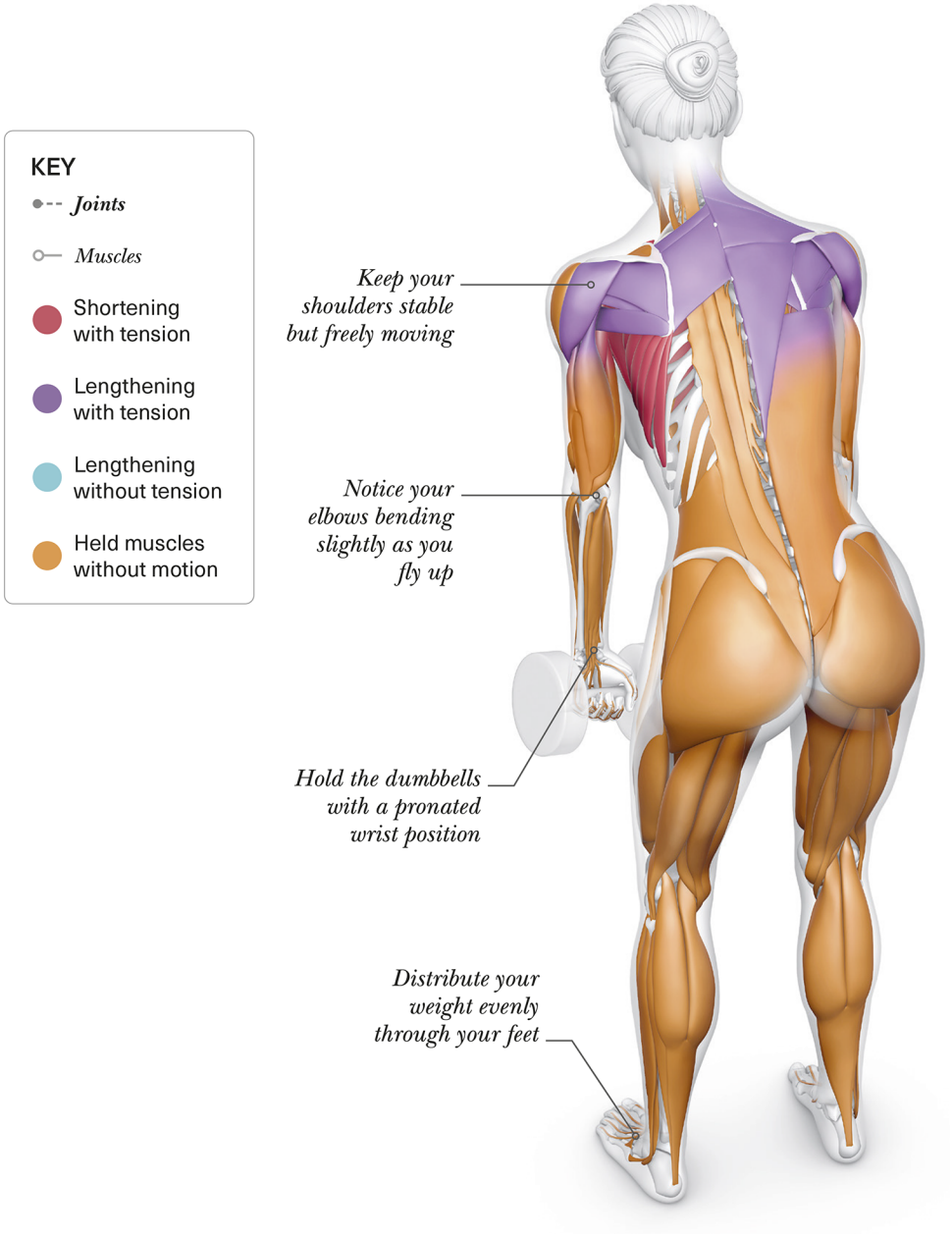
POSTERIOR-LATERAL VIEW

Upper **body** and **arms**

This exercise places tension on the **rear (posterior) deltoid** as well as muscles of the upper back, such as the **trapezius**. The **core muscles** alongside the **spinal extensors** will play an important role in stabilizing your torso and spine. This exercise is most challenging toward the top of the movement, so ensure you use a weight that you can control and perform with good technique.

STAGE TWO

Keeping tension in your shoulders, breathe in to lower your arms with control, resisting the load. Pause for 1 second in this bottom position to help reduce momentum going into your next rep, and to reset your breathing. Repeat stages 1 and 2.



Double-tap image to read the labels

Common mistakes

Lifting too much weight makes it harder to get the mechanics of the action right; a better bet for harder work is to boost your sets. The rear deltoid is a small muscle, so it takes focus to feel the work.

VARIATIONS

These variations can be useful alternatives if you experience shoulder discomfort from the dumbbell rear deltoid fly. The prone bench rear deltoid raise and banded deltoid row also offer a closer alignment between the line of resistance and the fibres of the rear delt. The arm path will be around 45° in both, with the trapezius providing support.

MACHINE REAR DELTOID FLY

This is an effective machine-based variation. Don't use too heavy a weight or retract your scapulae during the fly as it will bias your rhomboids and traps instead of your delts. For added challenge, hold at the top position for 1–2 seconds.

PREPARATORY STAGE

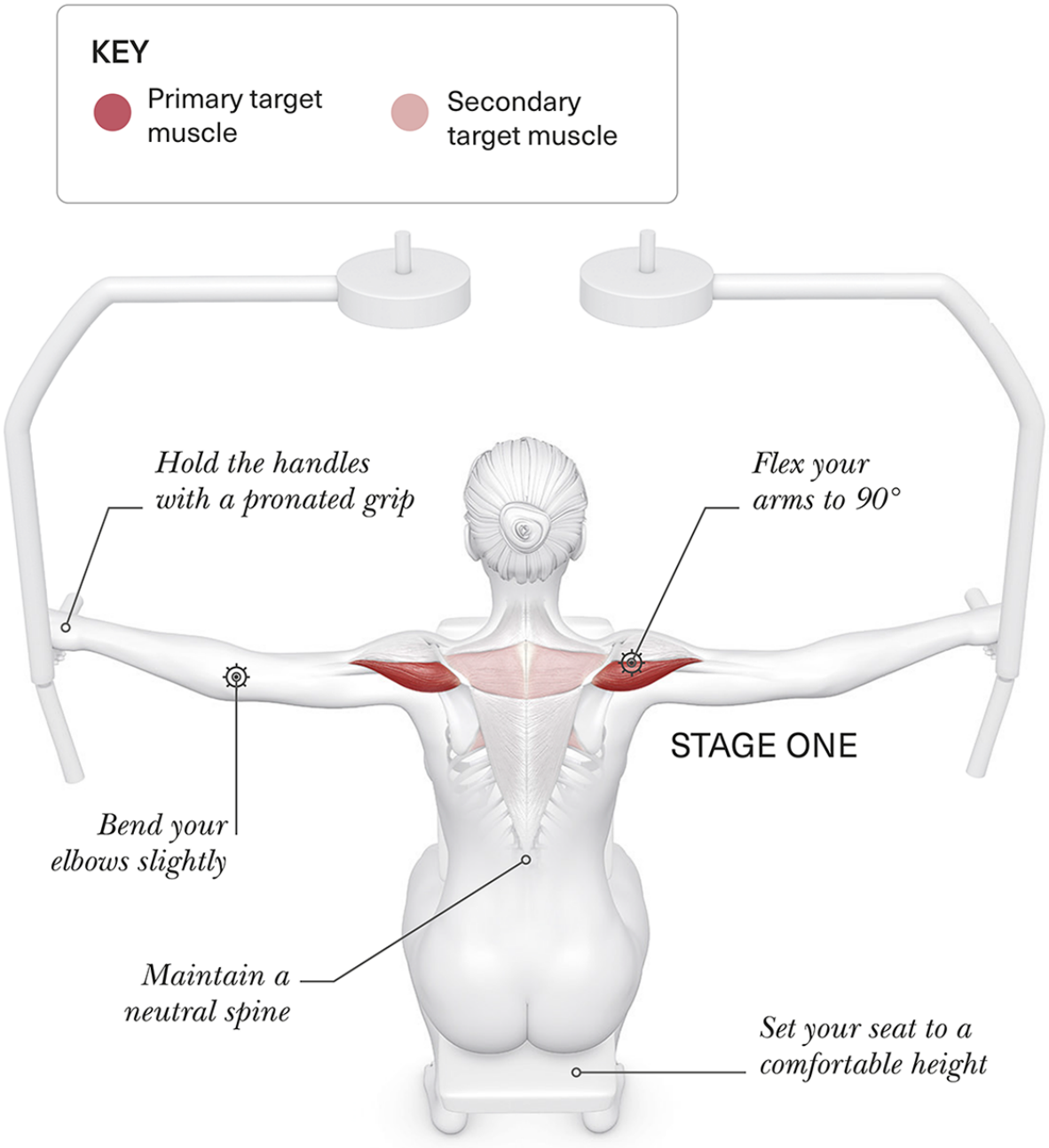
Sit with your chest and abdomen pressed against the pad. Hold onto the handles of the attachment with your arms directly in front of your shoulders.

STAGE ONE

Breathe in to brace your core, then breathe out as you fly your arms out to the sides. Keep your elbows slightly flexed and your arms parallel to the floor.

STAGE TWO

Breathe in to return your arms to the starting position, ensuring the movement is smooth and controlled. Repeat stages 1 and 2.



ℹ Double-tap image to read the labels

PRONE BENCH REAR DELTOID RAISE

Being positioned prone on the bench creates an opposing force to push through as you row, increasing your stability and allowing you to lift greater loads. For added challenge, hold at the top position for 1–2 seconds.

PREPARATORY STAGE

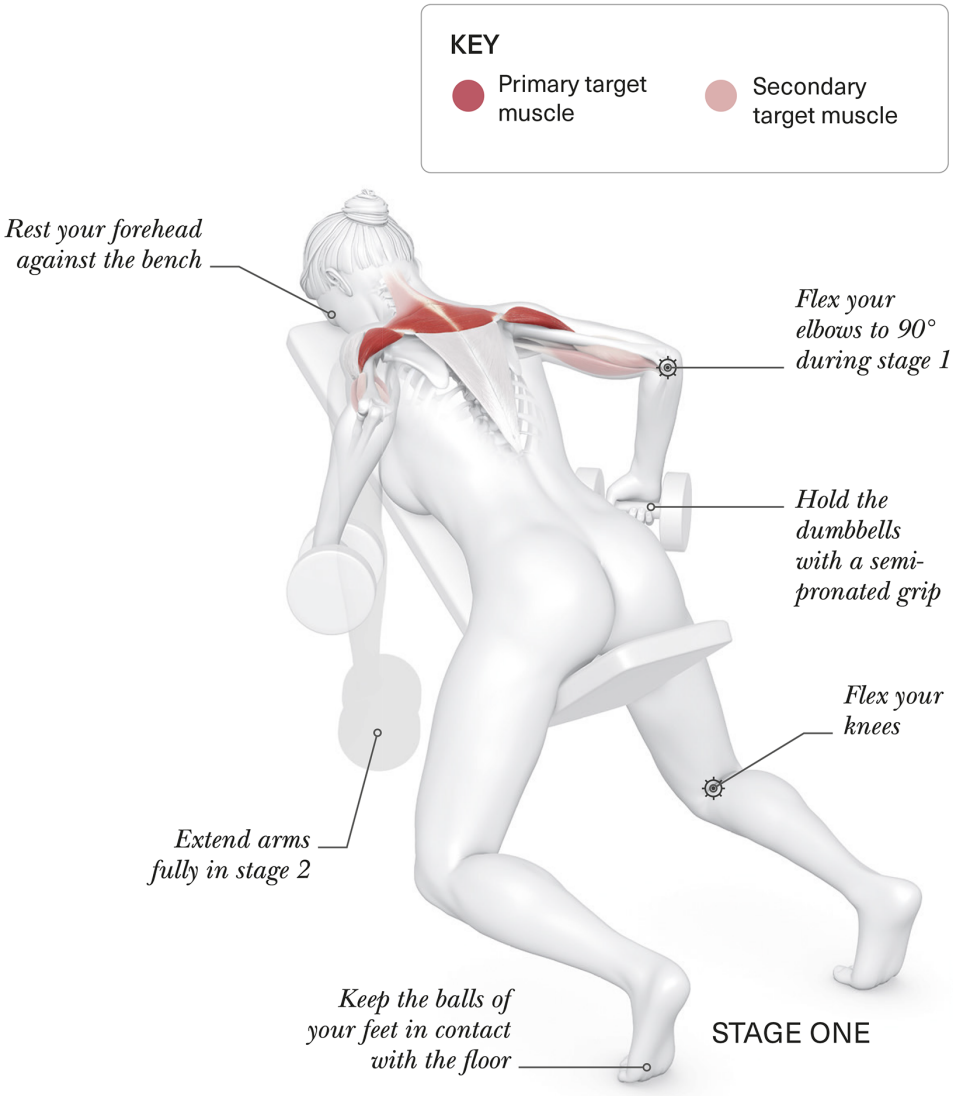
Lie on the bench and place your feet touching the floor, wider than shoulder-width apart. Hang your arms beneath your shoulders, weights in your hands.

STAGE ONE

Inhale to engage your abs. Breathe out as you row up, flexing your elbows and retracting your shoulder blades to bring the dumbbells to waist height.

STAGE TWO

Breathe in to lower the dumbbells back to the starting position, with control, so your elbows are fully extended again. Repeat stages 1 and 2.



Double-tap image to read the labels

BANDED DELTOID ROW

This resistance-band-based variation targets the rear deltoid and muscles of the upper back without the need for free weights. For more of a challenge, hold at the top position for 1–2 seconds.

PREPARATORY STAGE

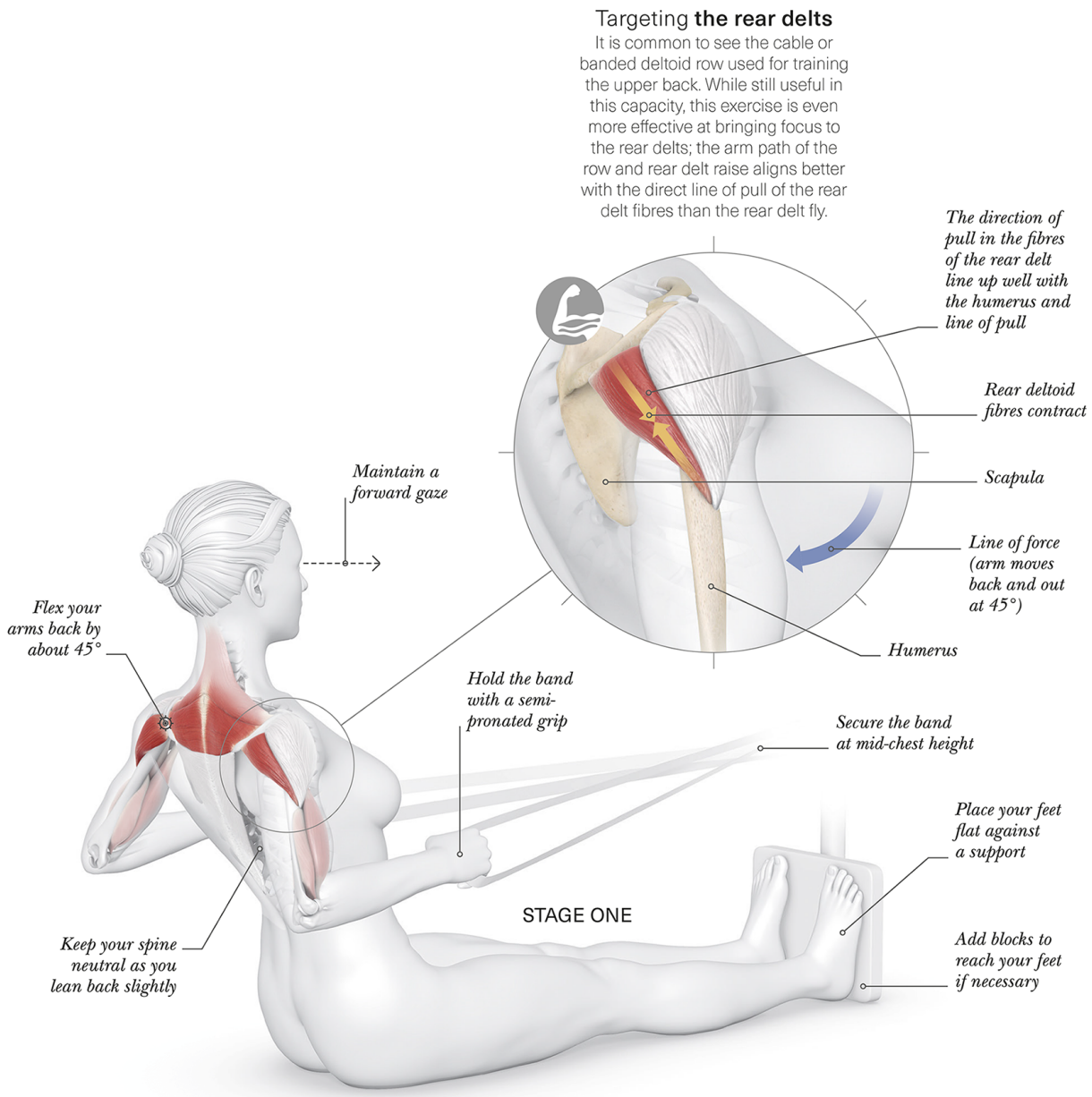
Sit with your legs flat on the ground, feet against a stable support or surface, and lean back slightly. Hold the ends of the band with your arms out in front of you.

STAGE ONE

Breathe in to engage your core, then breathe out as you row back, flexing your elbows out and back as you do so, without moving your spine.

STAGE TWO

Breathe in to return your arms to the starting position, maintaining control throughout the movement. Repeat stages 1 and 2.



ℹ Double-tap image to read the labels

Targeting **the rear delts**

It is common to see the cable or banded deltoid row used for training the upper back. While still useful in this capacity, this exercise is even more effective at bringing focus to the rear delts; the arm path of the row and rear delt raise aligns better with the direct line of pull of the rear delt fibres than the rear delt fly.

*"The **deltoid row and rear delt raise** train the rear delt through **a larger range of motion** than the rear delt fly."*

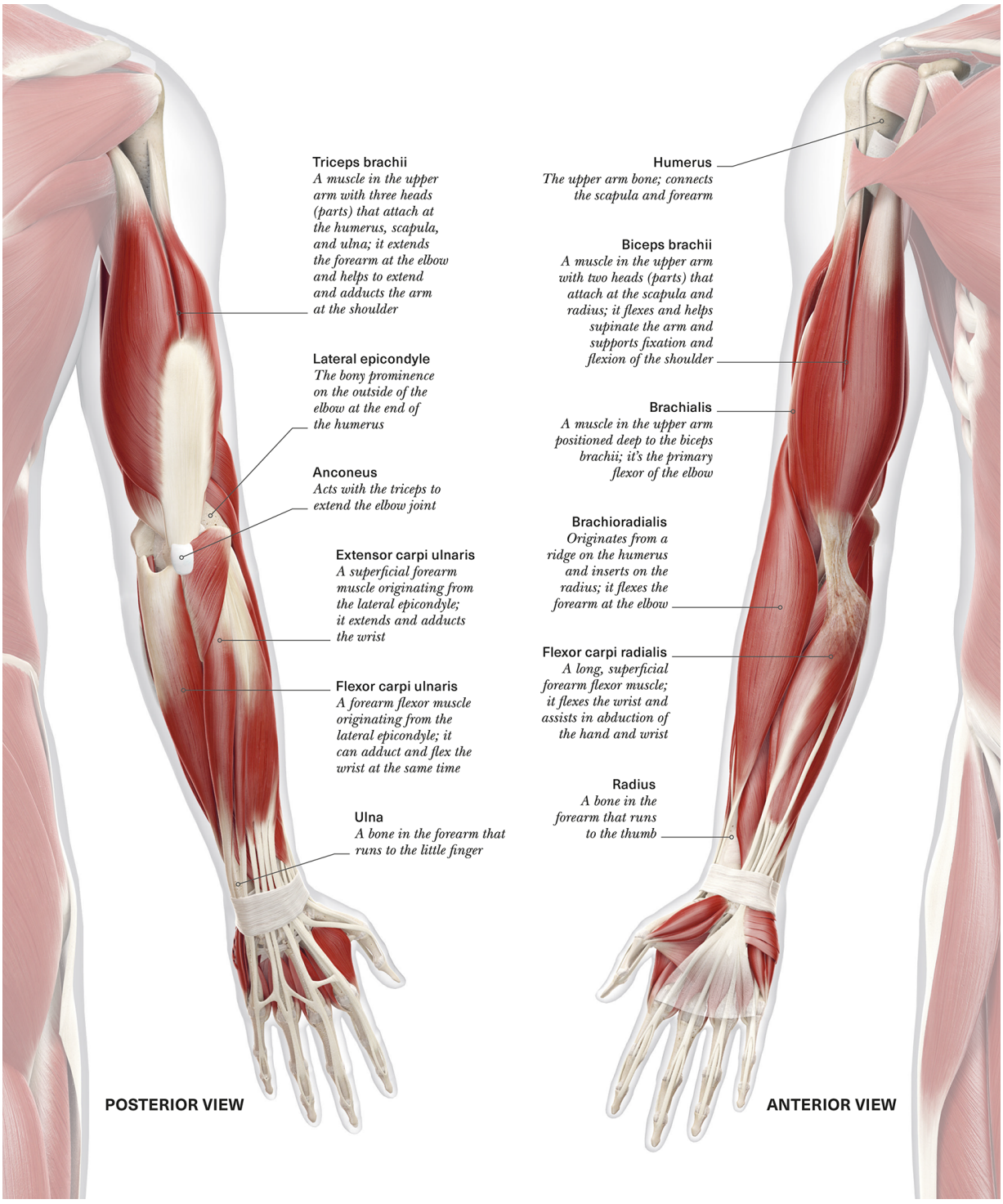
ARM EXERCISES

The main muscles responsible for movement in the arms are: the biceps brachii, positioned at the front of the upper arms; the triceps brachii, at the back of the upper arms; and the muscles of the forearms, which help in gripping weights and allow for control of your grip position.

The biceps and triceps muscles both attach to the forearm, the humerus, and the scapula. The biceps allows for flexion and supination at the elbow, and for fixation at the shoulder (helping to maintain its position). It also stabilizes the elbow and shoulder during exercises where they aren't in motion. The triceps aids in extension at the elbow, and has a large role in supporting the chest and shoulders in pressing movements.

Other elbow flexors, including the brachialis and brachioradialis, aid the biceps in coordinating elbow flexion throughout a large range of motion.

When performing flexion and extension-based exercises, remember to keep your elbow and shoulder positions fixed. Doing so will increase the amount of tension being placed on the target muscle, as well as helping to prevent stress to the elbow or shoulder joint.



Double-tap image to read the labels

POSTERIOR VIEW

Triceps brachii
A muscle in the upper arm with three heads (parts) that attach at the humerus, scapula, and ulna; it extends the forearm at the elbow and helps to extend and adducts the arm at the shoulder

Lateral epicondyle
The bony prominence on the outside of the elbow at the end of the humerus

Anconeus
Acts with the triceps to extend the elbow joint

Extensor carpi ulnaris
A superficial forearm muscle originating from the lateral epicondyle; it extends and adducts the wrist

Flexor carpi ulnaris
A forearm flexor muscle originating from the lateral epicondyle; it can adduct and flex the wrist at the same time

Ulna
A bone in the forearm that runs to the little finger

ANTERIOR VIEW

Humerus
The upper arm bone; connects the scapula and forearm

Biceps brachii
A muscle in the upper arm with two heads (parts) that attach at the scapula and radius; it flexes and helps supinate the arm and supports fixation and flexion of the shoulder

Brachialis
A muscle in the upper arm positioned deep to the biceps brachii; it's the primary flexor of the elbow

Flexor carpi radialis
A long, superficial forearm flexor muscle; it flexes the wrist and assists in abduction of the hand and wrist

Brachioradialis
Originates from a ridge on the humerus and inserts on the radius; it flexes the forearm at the elbow

Radius
A bone in the forearm that runs to the thumb

"Equally as important as leg strength, ***good arm strength facilitates higher loads*** *in other exercises."*

SECTION CONTENTS

Dumbbell biceps curl

Variations:

- Machine biceps curl
- Banded biceps curl
- EZ bar biceps curl
- Hammer curl

Dumbbell triceps extension

Variations:

- Unilateral cross-body triceps extension
- Banded unilateral triceps extension
- Triceps push-up

Rope triceps pushdown

Variations:

- Banded triceps extension
- Cable unilateral triceps pressdown
- Cross-cable triceps pressdown

DUMBBELL BICEPS CURL

This seated exercise safely trains the biceps while also challenging other elbow-flexor muscles. The use of dumbbells over a barbell allows for better adaptation to your individual mechanics; you can also use cables or resistance bands.

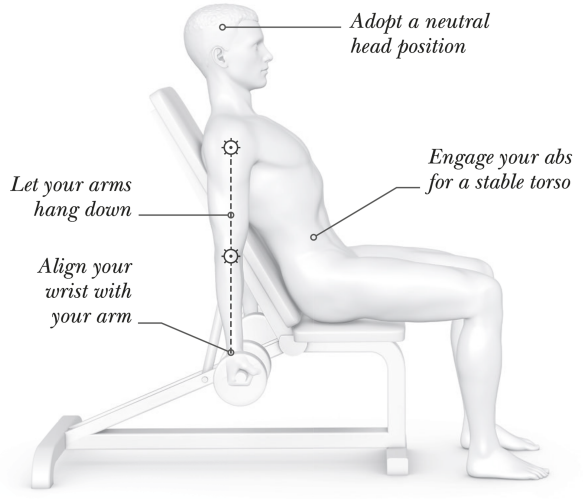
THE BIG PICTURE

The classic biceps curl involves lifting and lowering a weight while hinging at the elbow. Working seated, on an incline bench or a chair with an adjustable back support, rather than standing allows a greater range of movement and more muscle isolation. If you experience discomfort at the wrist, elbow, or shoulder, try switching to the cable or resistance-band variations (overleaf).

Beginners can start with 4 sets of 8–10 reps; discover other variations on and other targeted sets in the training programmes.

PREPARATORY STAGE

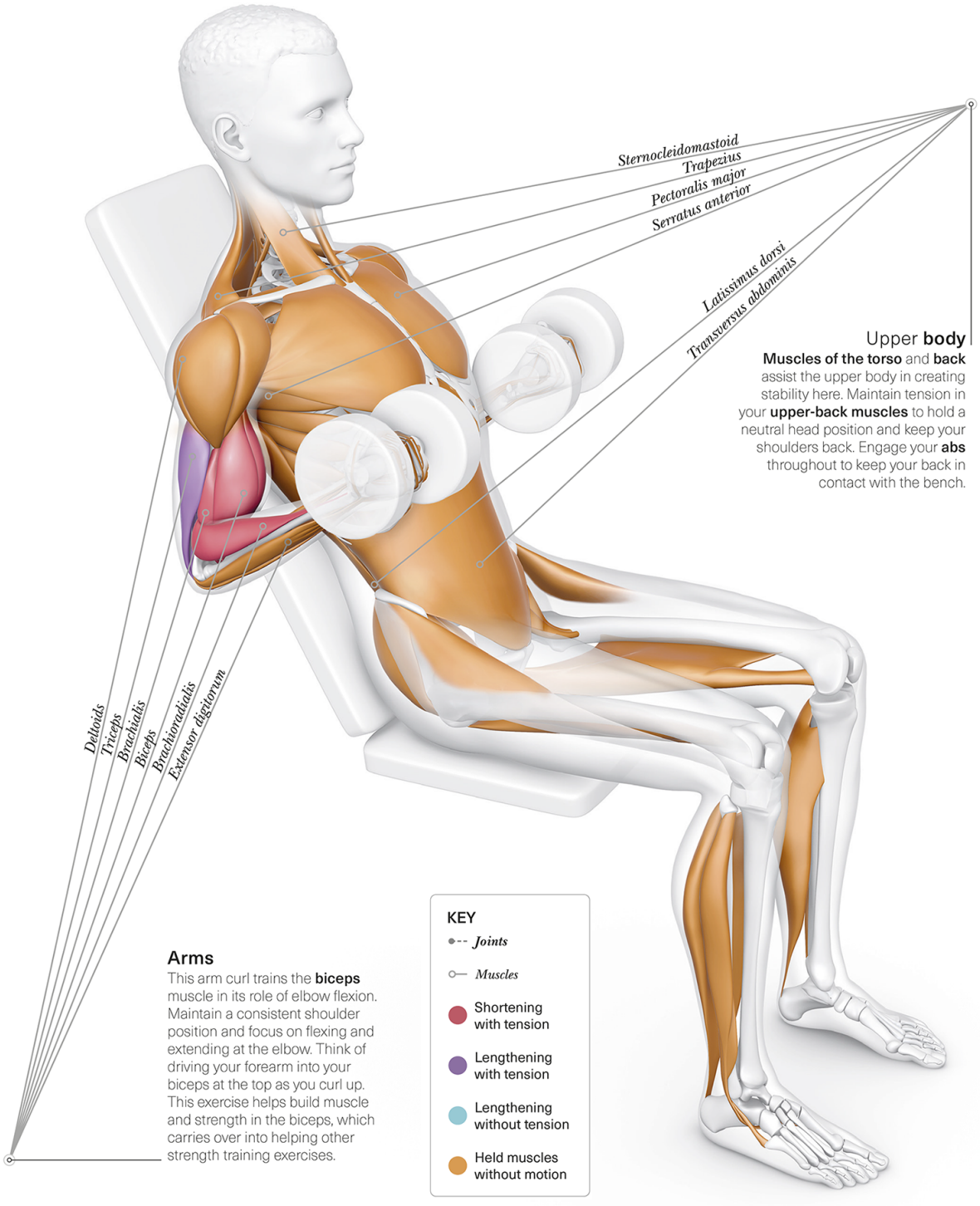
Sit on an incline bench with your back on the seat pad and your feet flat on the floor, shoulder-width apart. Grasp the dumbbells using an overhand standard grip and let your arms hang. Your wrist position will match the angle of your upper arm.



ℹ Double-tap image to read the labels

STAGE ONE

Take a breath in and engage your abs to help stabilize your core. Breathe out as you flex at the elbows and curl the dumbbells up toward your shoulders, keeping your shoulders still. Your feet should remain flat on the floor without any movement in your hips or torso.



ℹ Double-tap image to read the labels

ANTERIOR-LATERAL VIEW

Upper **body**

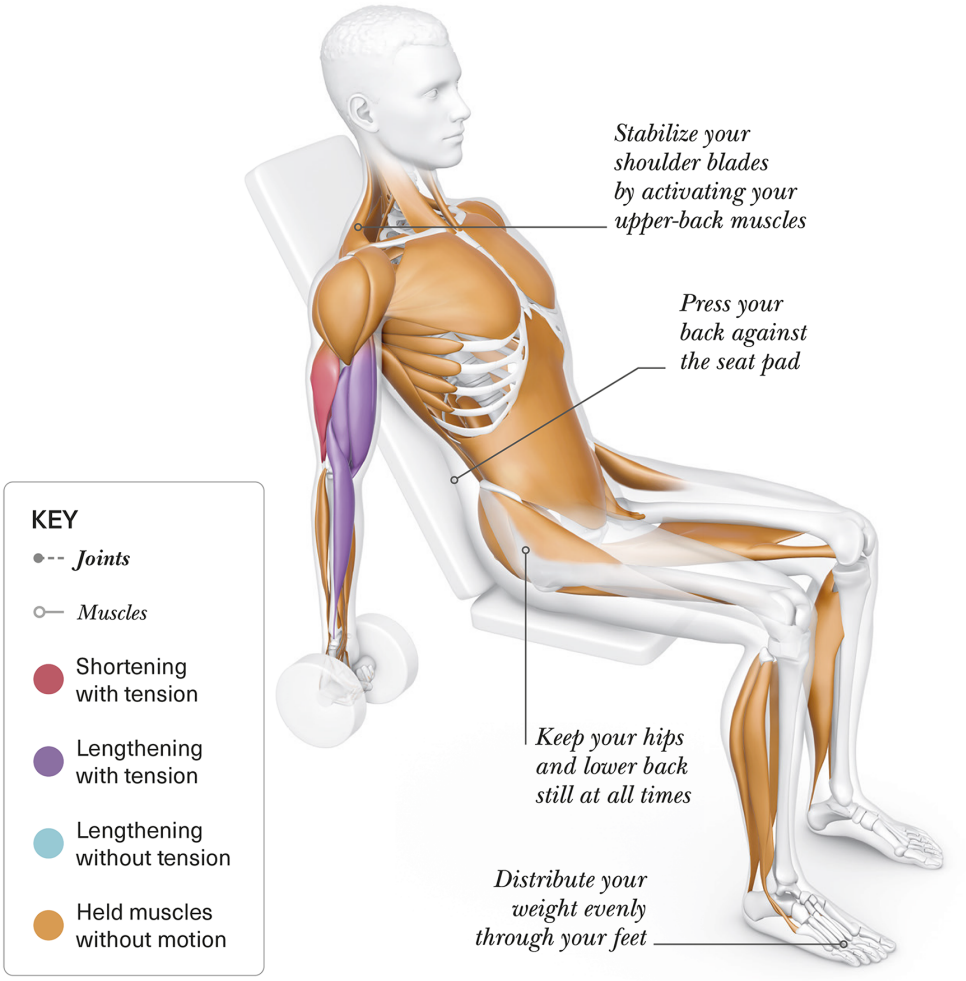
Muscles of the torso and **back** assist the upper body in creating stability here. Maintain tension in your **upper-back muscles** to hold a neutral head position and keep your shoulders back. Engage your **abs** throughout to keep your back in contact with the bench.

Arms

This arm curl trains the **biceps** muscle in its role of elbow flexion. Maintain a consistent shoulder position and focus on flexing and extending at the elbow. Think of driving your forearm into your biceps at the top as you curl up. This exercise helps build muscle and strength in the biceps, which carries over into helping other strength training exercises.

STAGE TWO

While keeping tension in your core and your elbows still, breathe in to return the dumbbells to the starting position, resisting the weight with your biceps. Reset your breathing and repeat stages 1 and 2.



Double-tap image to read the labels

Common mistakes

Instability in the shoulder, hips, or lower back can create momentum and allow other muscles, such as the front deltoid, to help move the dumbbells instead, so stabilizing muscles is key. Rather than starting with a heavy weight, go light until you've mastered the mechanics of the move and then increase incrementally.

VARIATIONS

The biceps curl is easily adaptable to different pieces of equipment. Make sure your upper-back muscles are engaged throughout to keep your shoulders from rounding, to protect them from injury, and to create more tension in the biceps brachii and elbow flexors during the movement.

MACHINE BICEPS CURL

Using a machine to perform this exercise allows for a fixed arm path, making this variation a useful way to practise the biceps curl movement. It works well either as a standalone exercise or within a combination.

PREPARATORY STAGE

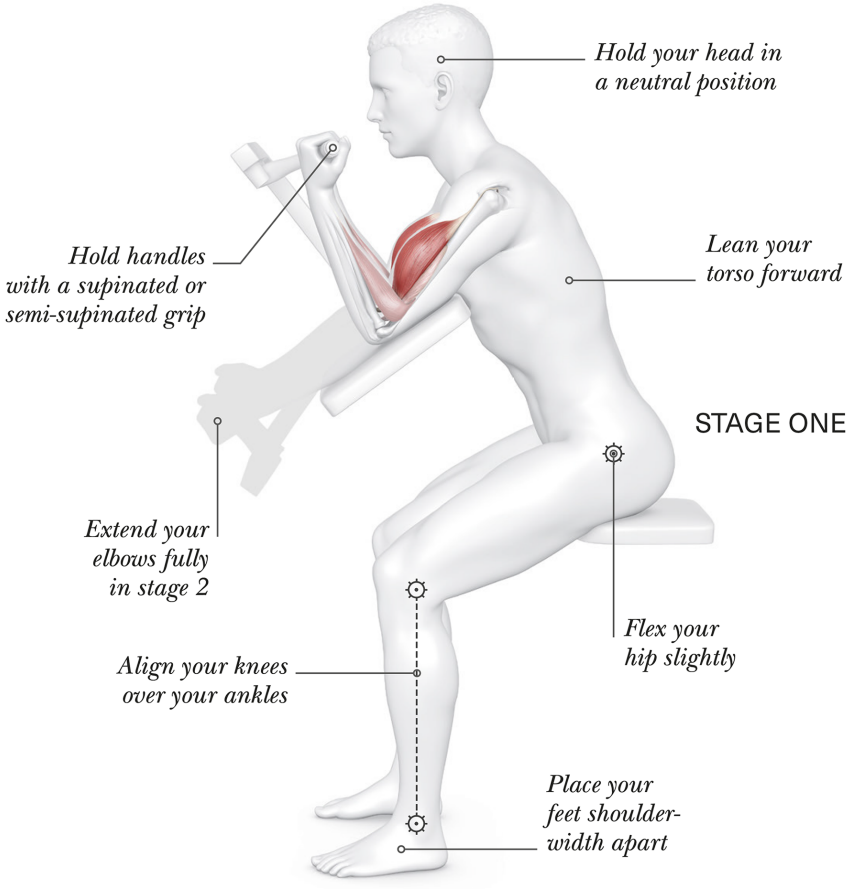
Sit leaning forward slightly and place your arms over the pad to grasp the handles. (The angle of the pad and the angle of the legs will vary by machine.)

STAGE ONE

Breathe in to engage your core, then breathe out as you curl up, pressing your upper arms down onto the pad. Avoid rounding your shoulders.

STAGE TWO

Breathe in as you lower your arms, extending your elbows fully. Engage your core and keep your spine neutral throughout. Repeat stages 1 and 2.



Double-tap image to read the labels

BANDED BICEPS CURL

This variation, which makes use of a resistance band,is useful if you experience discomfort in your joints when using weights. The band can help you to achieve a smooth, even movement throughout the exercise.

PREPARATORY STAGE

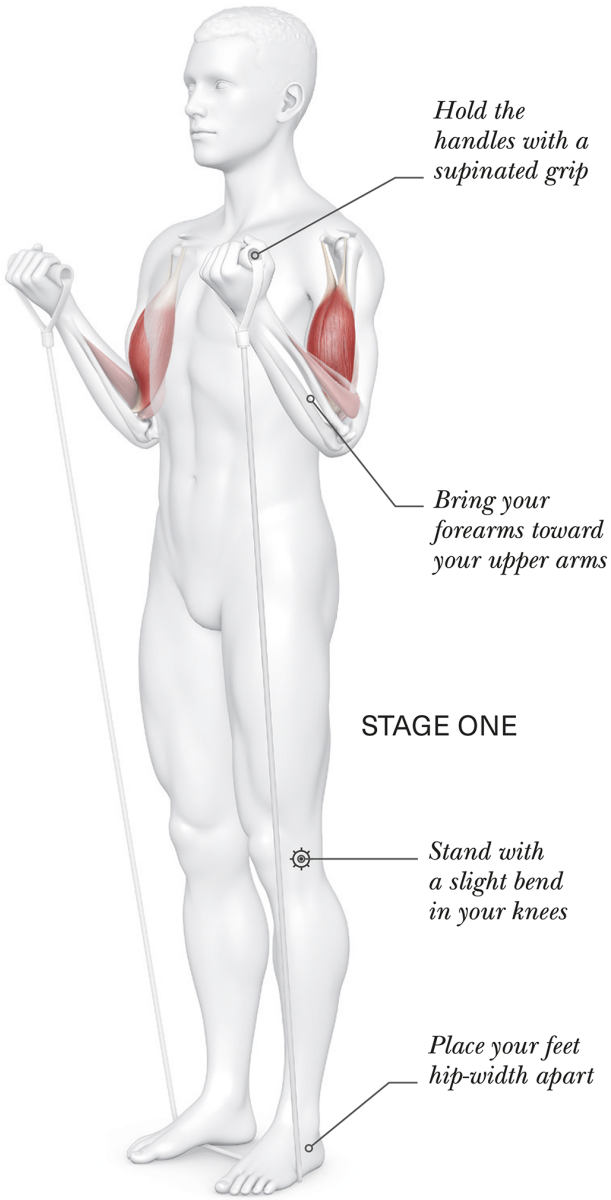
Place the band midway beneath your feet and stand tall with your arms down in front of your hips and your hands holding the handles.

STAGE ONE

Breathe in to engage your core, then breathe out as you curl up. Keep some tension in your upper back so your shoulders don't round forward.

STAGE TWO

Breathe in as you lower your arms with control, returning them to their starting position in front of your hips. Repeat stages 1 and 2.



ℹ Double-tap image to read the labels

EZ BAR BICEPS CURL

An EZ bar is a type of barbell with an undulating bar, designed to take pressure off your wrists during biceps curls; you could use a straight barbell. For an added challenge, hold at the top position for 1–2 seconds.

PREPARATORY STAGE

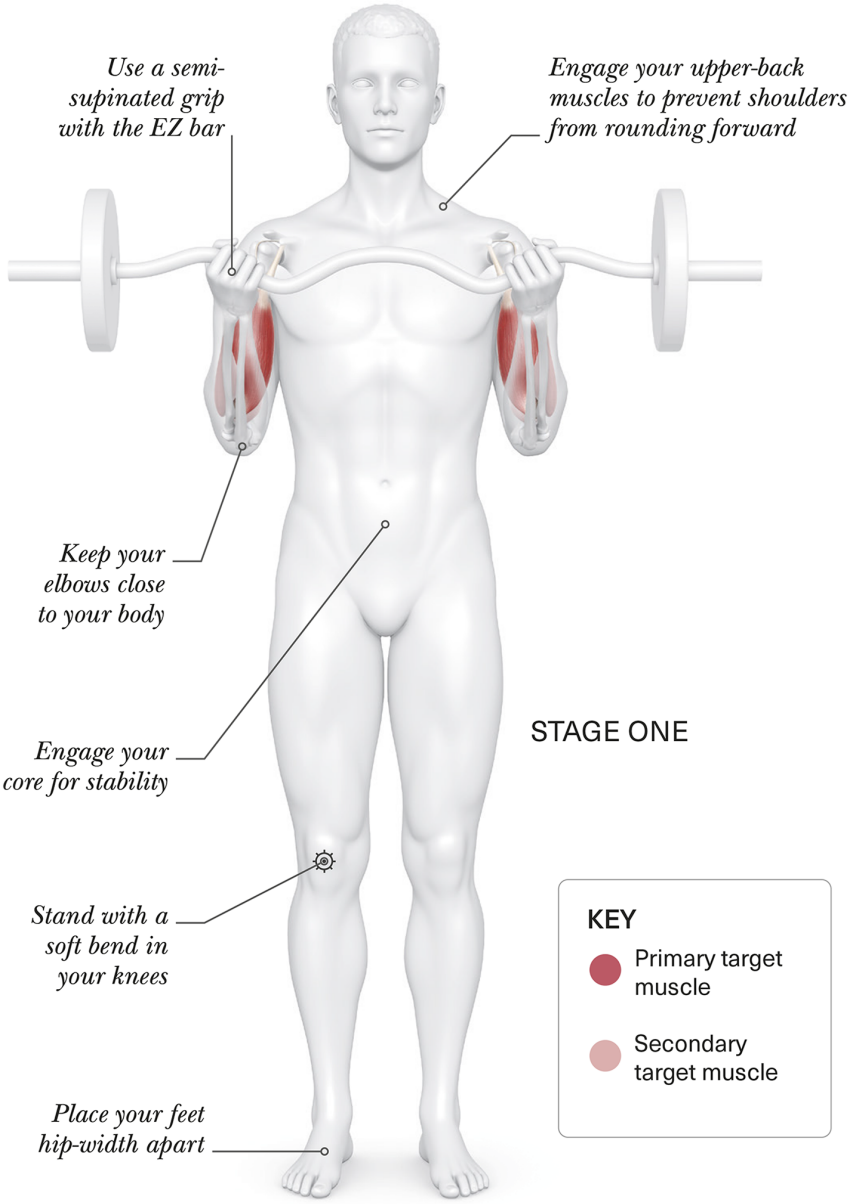
Hold the bar with your arms in front of you, elbows fully extended. Use a semi-supinated grip with an EZ bar, or a supinated grip with a straight barbell.

STAGE ONE

Breathe in, engage your core, then exhale as you curl up. Your elbows should remain in position, tight to the body.

STAGE TWO

Breathe in during the lowering phase, keeping your core engaged. Return your arms to the starting position. Repeat stages 1 and 2.



ℹ Double-tap image to read the labels

HAMMER CURL

This variation has the advantage of also challenging other elbow flexors, including the brachioradialis and brachialis. You can perform it bilaterally or unilaterally (See Image). Hold for 1–2 seconds at the top position for more of a challenge.

PREPARATORY STAGE

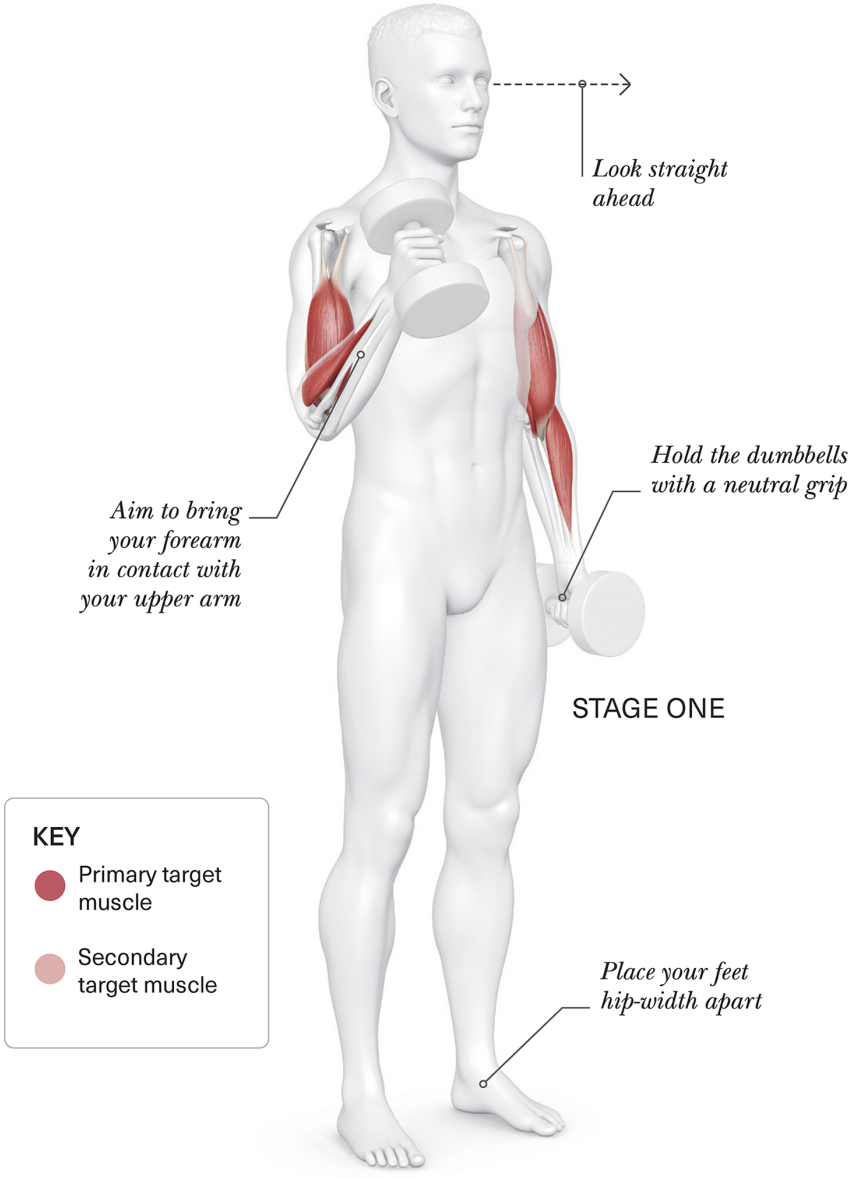
Hold a dumbbell in each hand and stand tall with your arms hanging at your sides. Keep your wrist in a neutral position.

STAGE ONE

Breathe in, engage your core, then breathe out as you curl up (either with one arm or both), flexing your elbow to the top position.

STAGE TWO

Breathe in as you lower your arm(s). Repeat stages 1 and 2, being sure to work both arms equally if performing the exercise unilaterally.



ℹ Double-tap image to read the labels

DUMBBELL TRICEPS EXTENSION

Also known as "the skull crusher", this exercise builds muscle and strength in the triceps in the upper arm in a movement that can benefit other strength exercises. You can perform this lying either on a bench or on the floor; all you need is a pair of dumbbells.

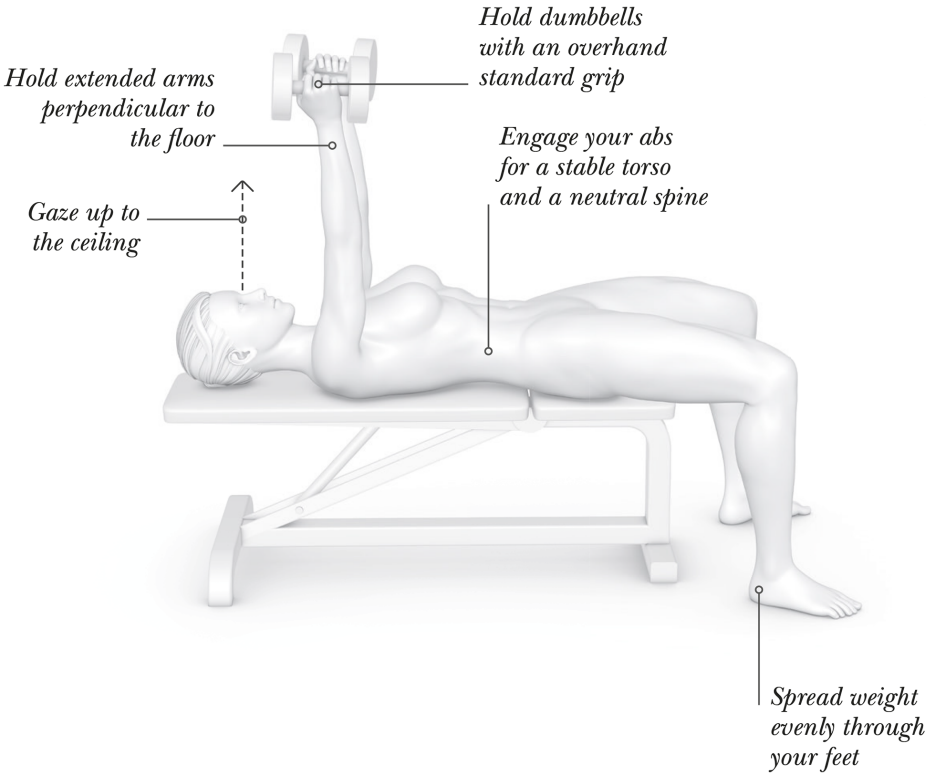
THE BIG PICTURE

Your core and legs stay still and strong while you bend your elbows to lower and lift the weights above your head. Since the weights are above you, a secure overhand standard grip is best. If you experience any joint discomfort, try switching to a cable-based or resistance-band variation (see overleaf).

Beginners can start with 4 sets of 8–10 reps; discover other variations on and other targeted sets in the training programmes.

PREPARATORY STAGE

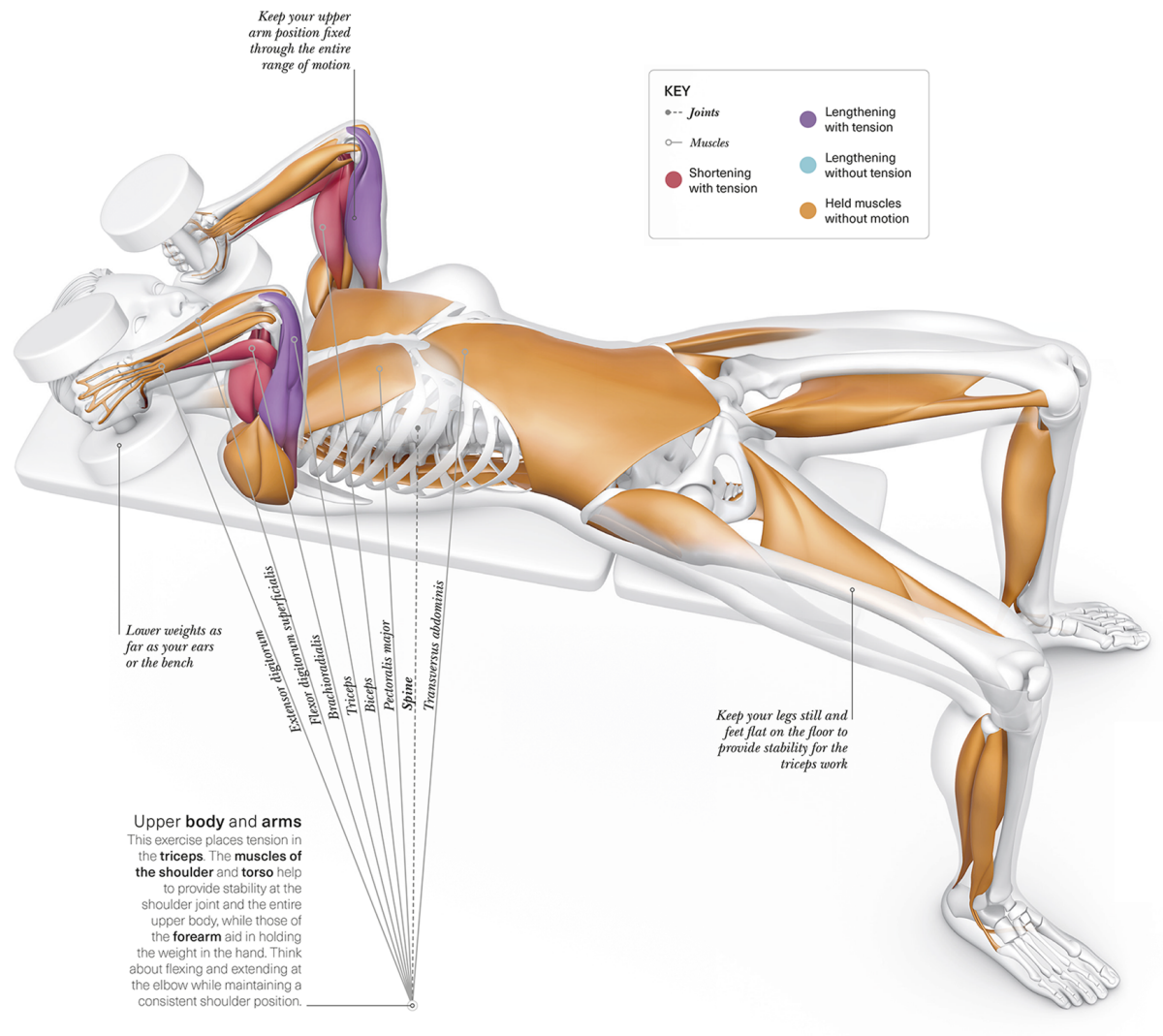
Lie flat on the bench with your buttocks and head fully on it and place your feet flat on the floor, wider than hip-width apart; if working on the floor, bend your knees to improve stability. Hold the dumbbells above your knees then lift them directly above your shoulders.



Double-tap image to read the labels

STAGE ONE

Take a breath in and engage your abs for a stable core. Breathe out as you start to flex at the elbows and resist the dumbbells as they travel toward the top of your head. Keep your shoulders and upper back stable and in a neutral position; your upper arm position should stay fixed as your elbow flexes and your feet remain flat on the floor. To add challenge, hold at this lower position for 1–2 seconds.



ℹ Double-tap image to read the labels

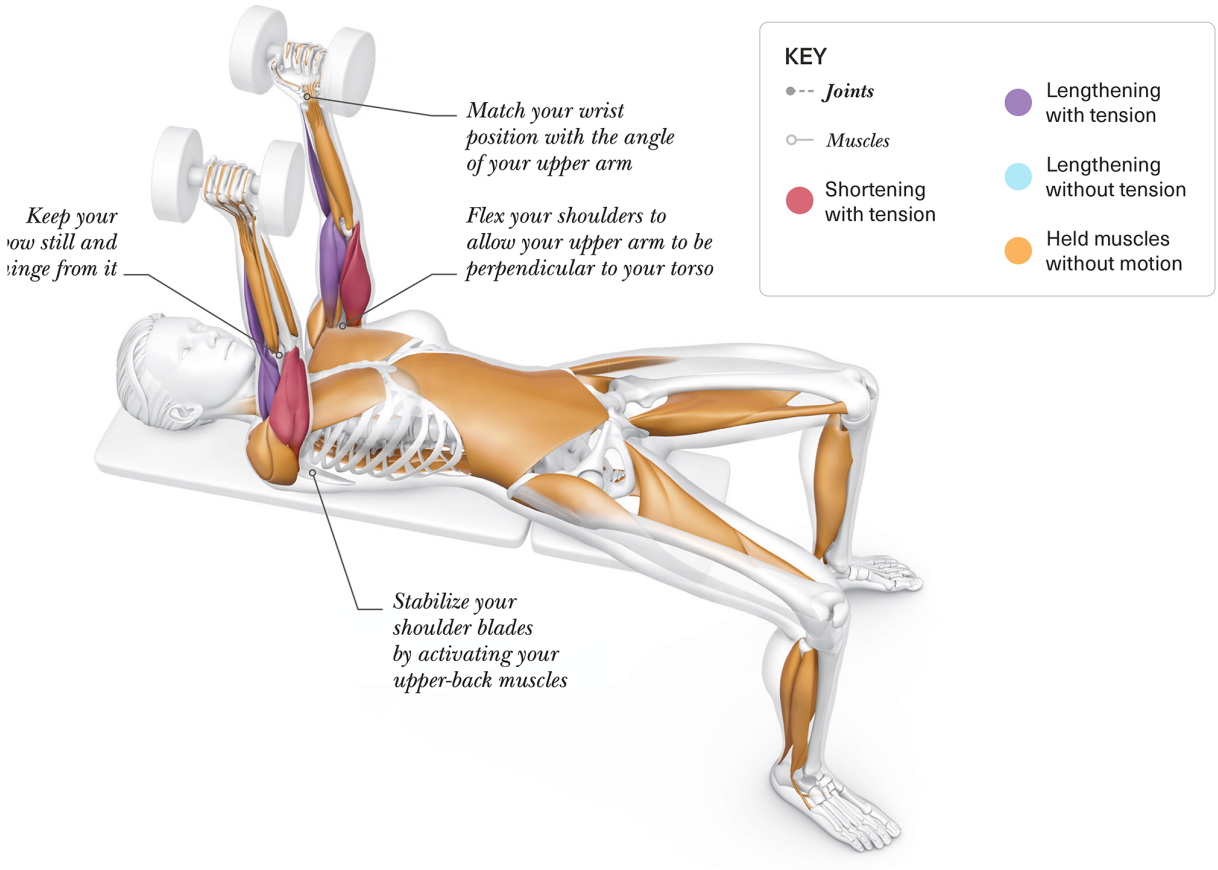
SUPERIOR-ANTERIOR-LATERAL VIEW

Upper **body** and **arms**

This exercise places tension in the **triceps**. The **muscles of the shoulder** and **torso** help to provide stability at the shoulder joint and the entire upper body, while those of the **forearm** aid in holding the weight in the hand. Think about flexing and extending at the elbow while maintaining a consistent shoulder position.

STAGE TWO

Breathe in, then, while maintaining stability in your core, upper back, and shoulders, breathe out as you use your triceps to extend your arm back toward the upright starting position. Reset your breathing and repeat stages 1 and 2.



Double-tap image to read the labels

Common mistakes

It's important not to force your arms into an unnatural path. If you are a wider or larger individual, your elbows may not be pointed straight ahead. Once you're in position, you'll find your arms have a natural path. If your arm path is uncomfortable for your elbow or shoulder, use one of the single-arm, cable-based, or resistance-band variations (overleaf). Don't allow your shoulders to roll or shrug up during this movement: the only joint movement should be at the elbow.

VARIATIONS

These variations can be useful if you are new to the triceps extension. While ostensibly quite different, these exercises all target the triceps brachii. When working unilaterally, remember to perform the same number of reps on each arm.

UNILATERAL CROSS-BODY TRICEPS EXTENSION

If you experience elbow discomfort, you may find it easier to perform a lying triceps extension unilaterally. This version also works well for those with wider frames.

PREPARATORY STAGE

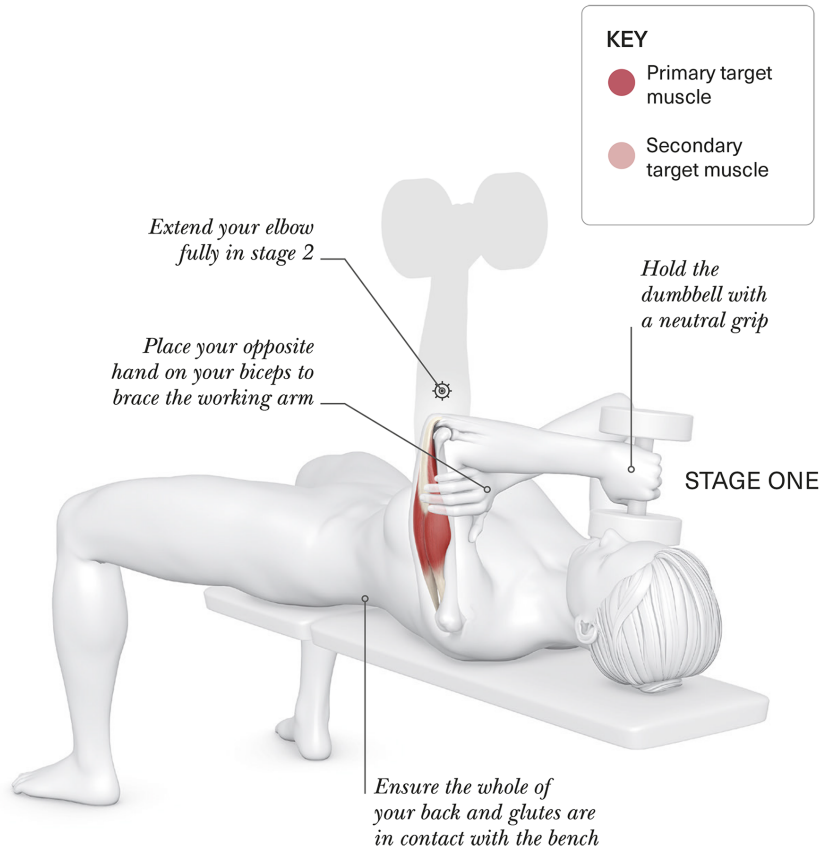
Lie on the bench with your legs abducted, feet flat on the floor. Hold a dumbbell in your working arm, elbow extended, and support with your other arm.

STAGE ONE

Breathe in to brace your core. Then, while breathing out, flex your extended arm at the elbow to bring the dumbbell to your opposite cheek.

STAGE TWO

Breathe in to return your arm to the starting position. Repeat stages 1 and 2, then perform the exercise on the other side of your body.



Double-tap image to read the labels

BANDED UNILATERAL TRICEPS EXTENSION

This exercise, performed on one side at a time, is often referred to as a “triceps kickback”. Fix your shoulder into position first, then focus on extending your arm backward.

PREPARATORY STAGE

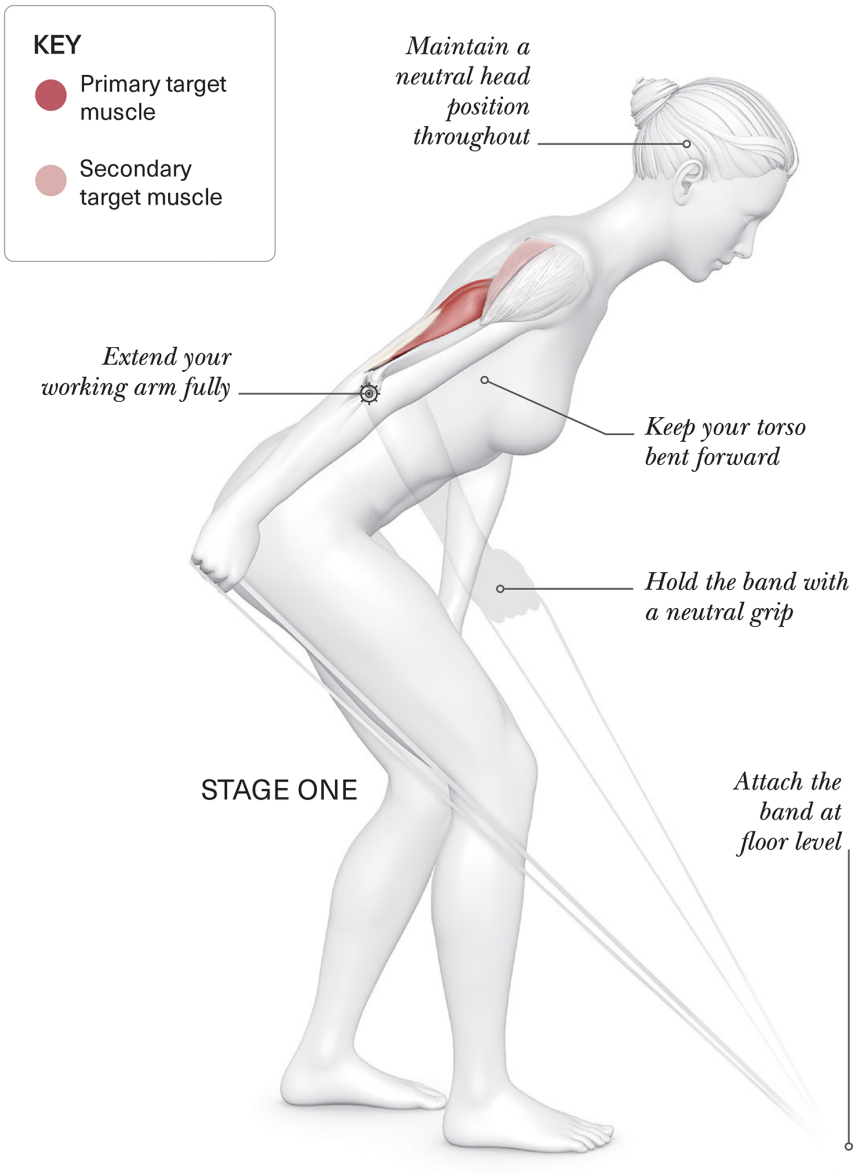
Stand with your feet hip-width apart in a staggered stance, knees soft, and bend forward at the hips to around 135°. Hold the band with your elbow flexed.

STAGE ONE

Breathe in and engage your core. Breathe out as you extend your arm fully. Keep some tension in your upper back to avoid rounding your shoulders.

STAGE TWO

Breathe in to return your arm to its starting postion, with control. Repeat stages 1 and 2, then switch sides (remembering to reverse your stance, too).



Double-tap image to read the labels

TRICEPS **PUSH-UP**

This push-up variation with a modified hand position and arm path trains the chest, triceps, and shoulders. It is a useful bodyweight alternative to the lying triceps extension, challenging the body in a similar way.

PREPARATORY STAGE

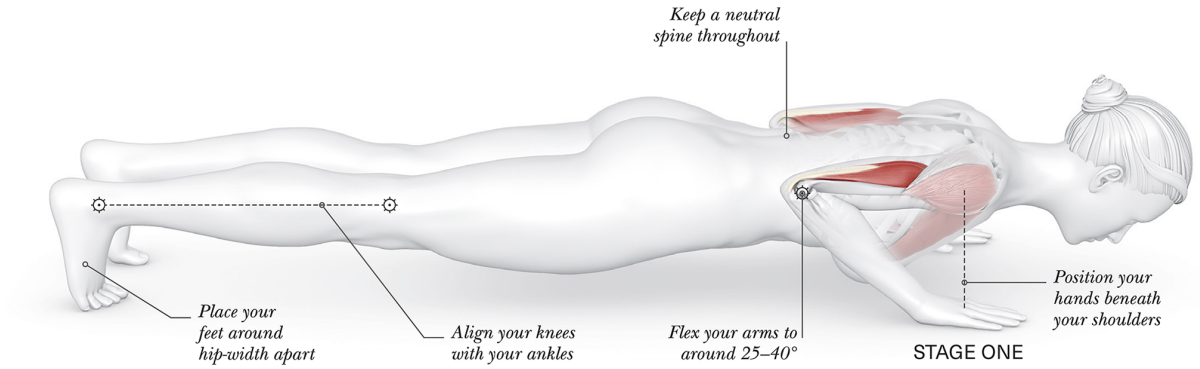
Position yourself prone with your arms out in front of you, hands at or just inside shoulder-width. Flex your elbows slightly.

STAGE ONE

Engage your core, then breathe in as you lower your body toward the ground, flexing your elbows and squeezing your arms against your ribcage.

STAGE TWO

Breathe out as you drive up, extending your elbows almost fully to come back to the starting position. Repeat stages 1 and 2.

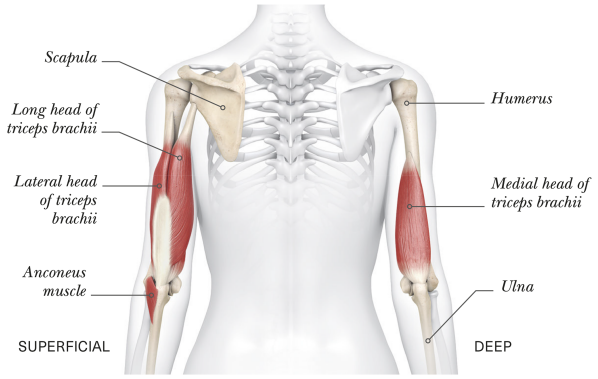


Double-tap image to read the labels

*"Improving your knowledge of **triceps anatomy** helps you to better understand whether an exercise works **one, two, or three triceps heads**."*

A look at **the triceps**

The triceps brachii is unique in having three heads or divisions: the lateral and medial heads attach at the humerus and in the elbow, while the long head attaches at the scapula or shoulder blade. Some movements train all three heads at the same time while others train just one or two. If you alter your shoulder position, you can potentially put more load on the long head without affecting the other two. Knowing more about the anatomy and where each head attaches and how it lines up with the resistance helps you to make sense of why one exercise is better than another. The best example of an exercise that works all three triceps heads is the cross-cable pressdown.



Double-tap image to read the labels

POSTERIOR VIEW

ROPE TRICEPS PUSHDOWN

This pushdown exercise targets the triceps, the large muscle at the back of the upper arm. Here, a cable machine with a rope attachment is used, rather than a barbell or fixed attachment; this makes it easier to adapt the move to your individual mechanics and mobility limitations.

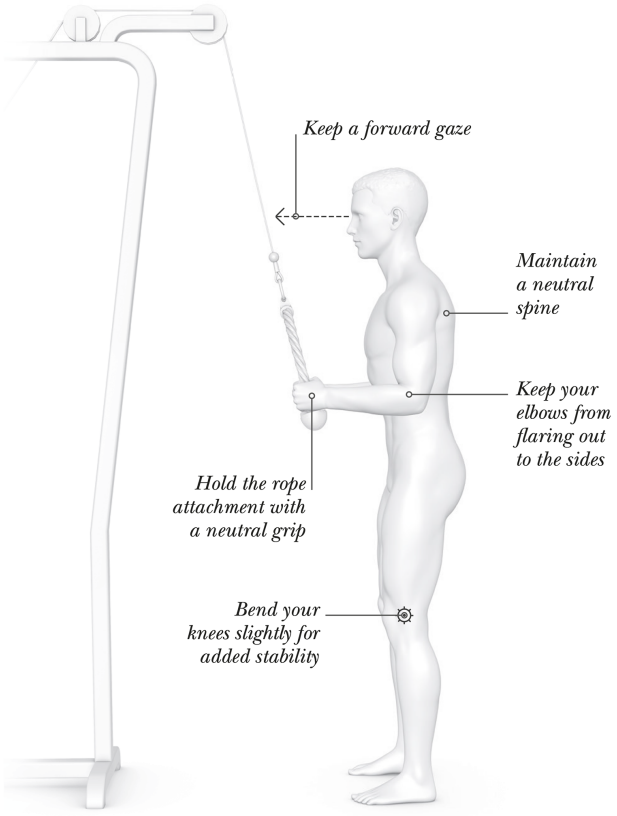
THE BIG PICTURE

Holding the right posture and moving your arms only from the elbows are both essential for the success of this vertical pushing-down movement. Set the weights and fix a rope attachment (with two parts) to the cable pulley machine; adjust the cable pulley to its top position. If you experience any joint discomfort, try switching to other variations, including an alternative cable version and one using resistance bands (overleaf).

Beginners can start with 4 sets of 8–10 reps; discover other variations on and other targeted sets in the training programmes.

PREPARATORY STAGE

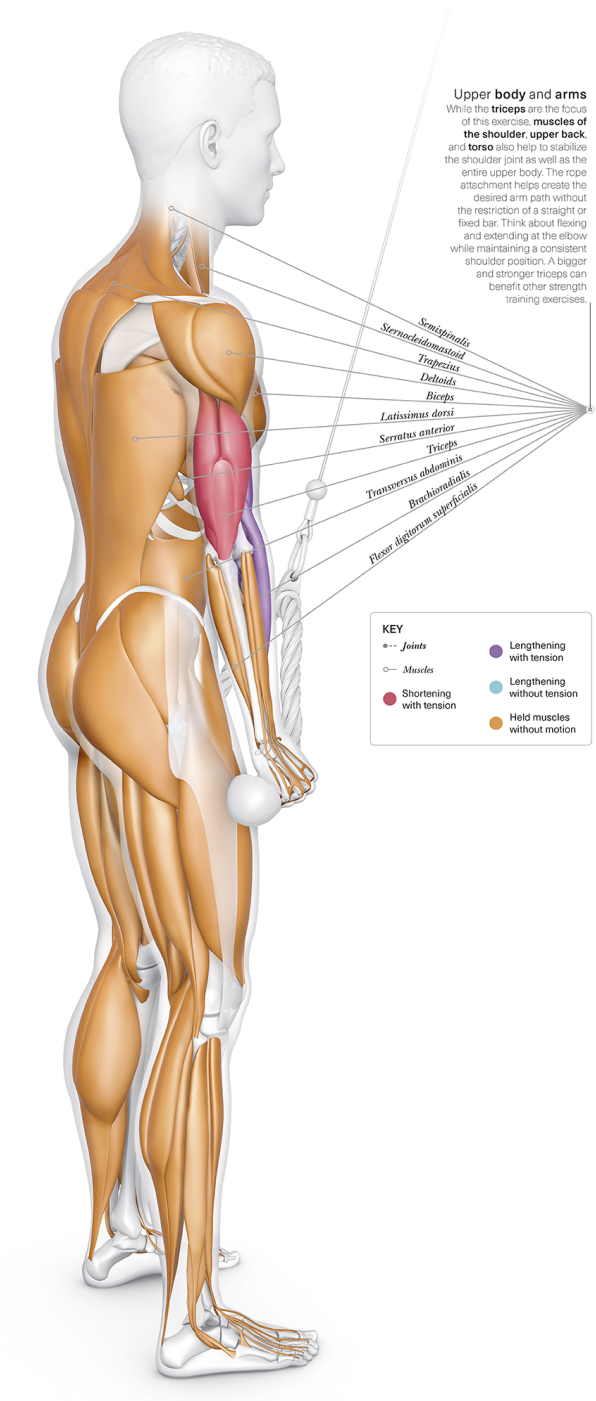
Set up the machine and grasp the bottom of the rope attachment. Take 1–2 steps back and stand tall, feet shoulder-width apart. Place tension in the muscles of your upper back for stability, and allow your elbows to flex to around 65–75°.



ℹ Double-tap image to read the labels

STAGE ONE

Inhale and engage your abs. Breathe out as you extend your elbows, using your triceps to push the rope down. Do not round your shoulders at the bottom of the range. To add challenge, hold for 1–2 seconds in this position.



ℹ Double-tap image to read the labels

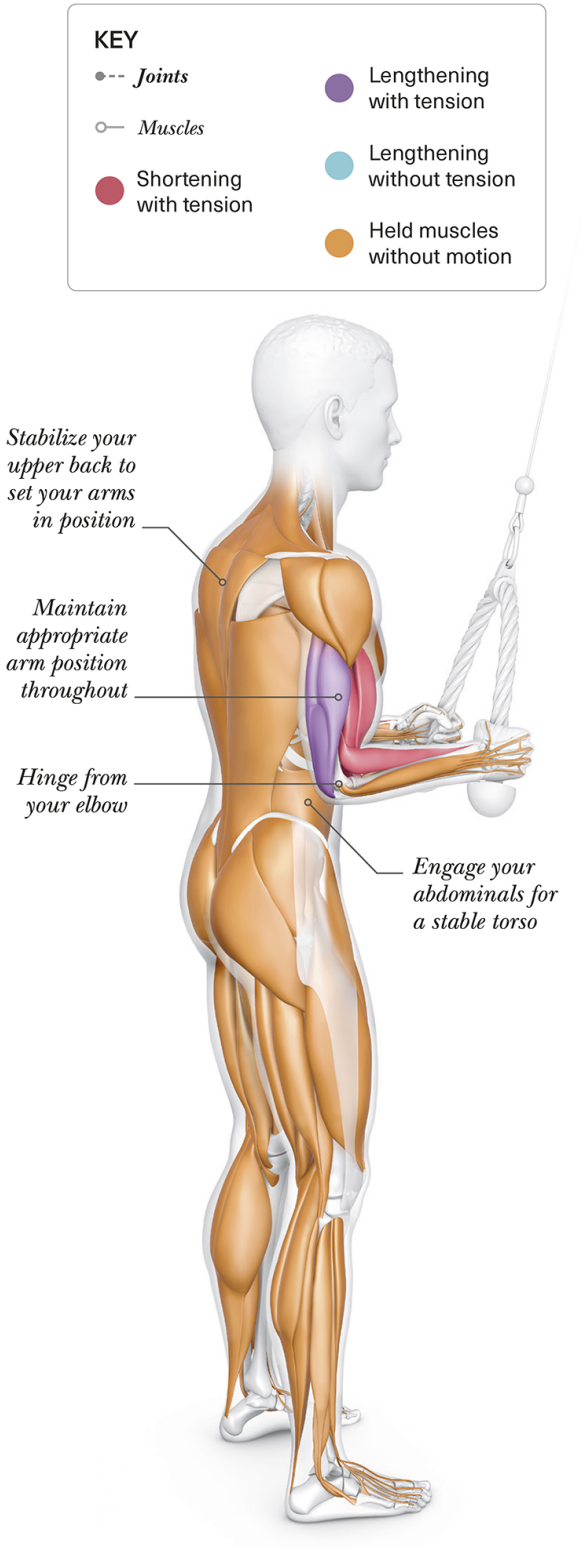
POSTERIOR-LATERAL VIEW

Upper **body** and **arms**

While the **triceps** are the focus of this exercise, **muscles of the shoulder**, **upper back**, and **torso** also help to stabilize the shoulder joint as well as the entire upper body. The rope attachment helps create the desired arm path without the restriction of a straight or fixed bar. Think about flexing and extending at the elbow while maintaining a consistent shoulder position. A bigger and stronger triceps can benefit other strength training exercises.

STAGE TWO

Maintaining stability in your core, upper back, and shoulders, breathe in and resist the rope with your triceps as you return it to its starting position. Reset your breathing and repeat stages 1 and 2.



Double-tap image to read the labels

Common mistakes

Leaning your body forward past the cable's vertical hanging line is bad form and doesn't isolate the triceps for the work. Stand tall, not too close to the cable; the rope attachment should simply move up and down in the same vertical line, without any forward or backward motion.

VARIATIONS

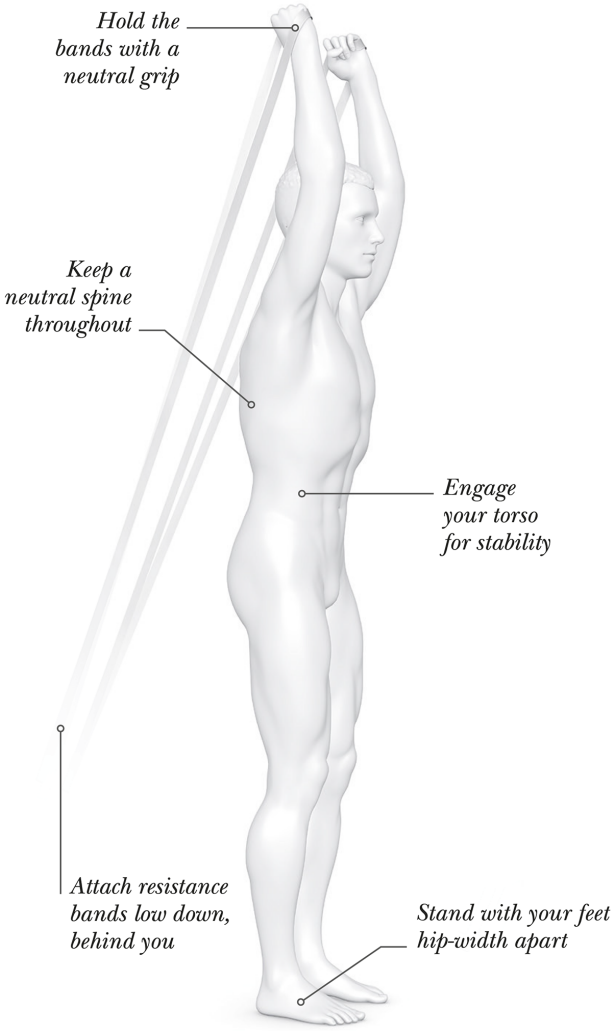
It is important to position your shoulders correctly and avoid rounding them during each of these movements. These variations target the triceps brachii but are a great alternative if you experience any discomfort performing the rope pulldown.

BANDED TRICEPS EXTENSION

This resistance-band-based variation is useful for when you don't have access to machines. Bringing the bands over your shoulders also ensures the lines of resistance are properly lined up with your arm paths.

GETTING INTO POSITION

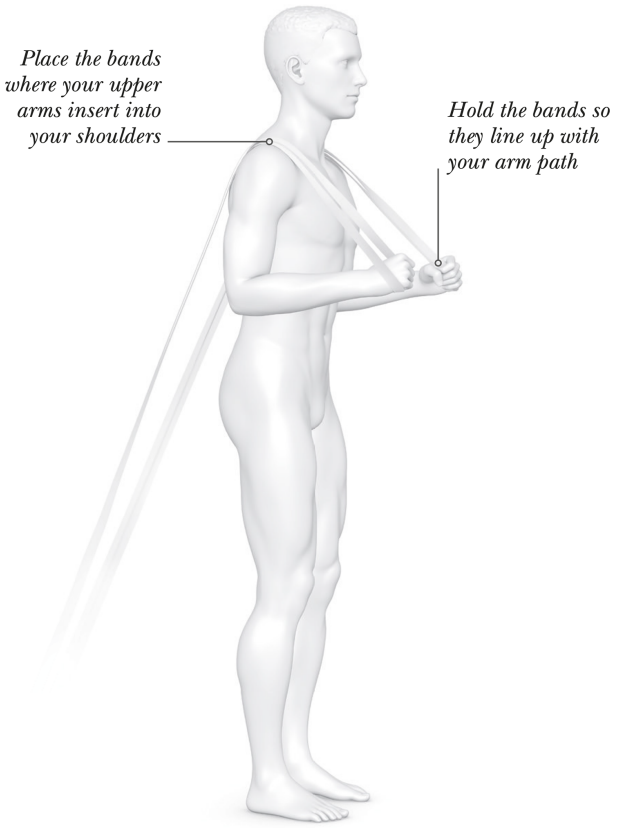
Secure the resistance bands at a low level and stand facing away from them with a soft bend in your knees. Hold a band in each hand. Raise your arms high.



Double-tap image to read the labels

PREPARATORY STAGE

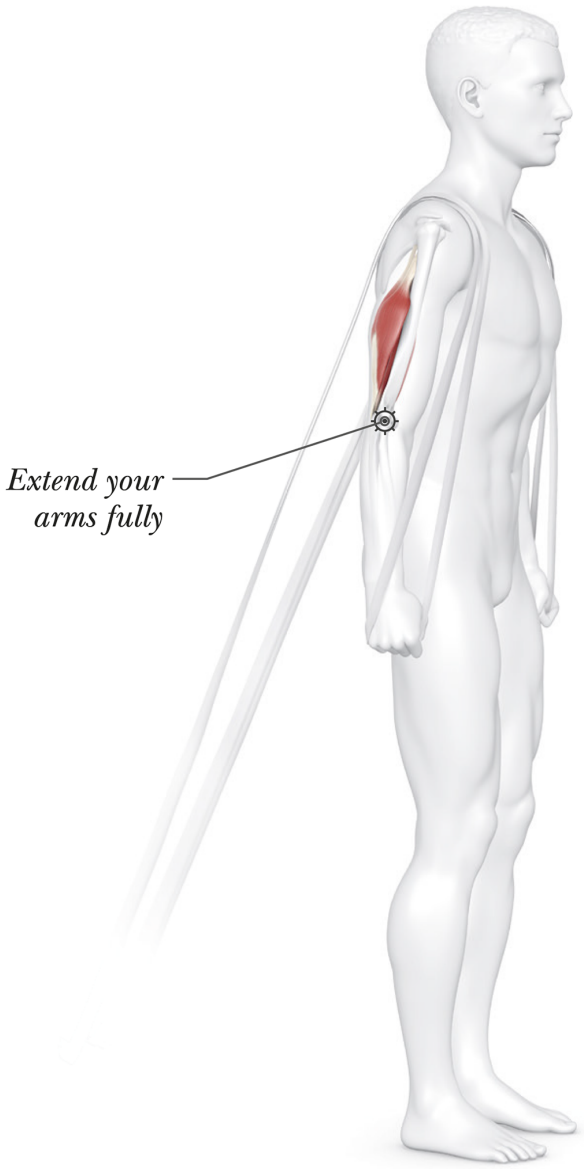
Extend your arms out to bring the resistance bands over your shoulders. Hold the ends of the bands in front of you, with your elbows flexed.



Double-tap image to read the labels

STAGE ONE

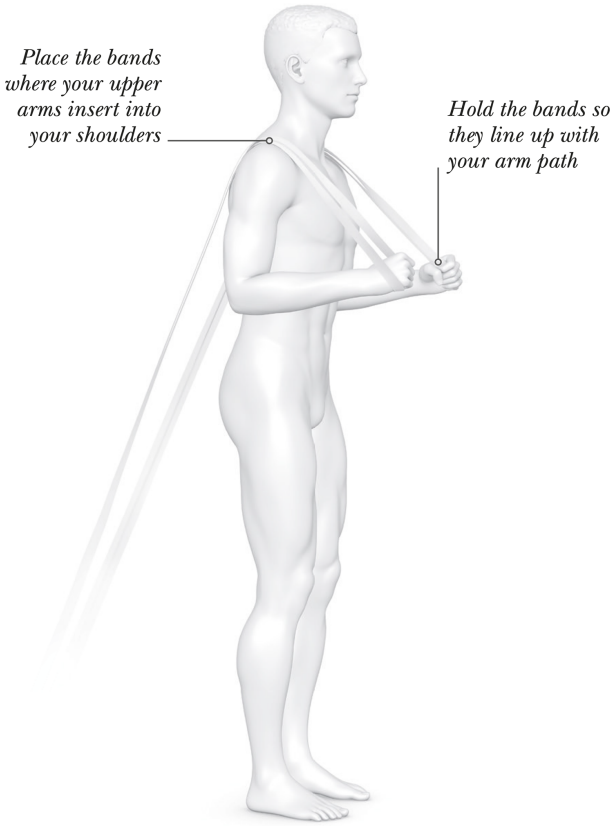
Inhale to engage your abs, then breathe out as you extend your elbows fully, shoulders pulled back, and upper arms remaining in line with your torso.



Double-tap image to read the labels

STAGE TWO

Breathe in to return your arms to the starting position, flexing at the elbows and moving the bands with control. Repeat stages 1 and 2.



ⓘ Double-tap image to read the labels

*"Lining up **the path of resistance** (cable or band) with **the arm path** used in the exercise can **limit risk of injury** to the joint.*

CABLE UNILATERAL TRICEPS PRESSDOWN

This variation requires only a single cable to train one arm at a time. Focus on achieving the correct shoulder position before extending your arm back.

PREPARATORY STAGE

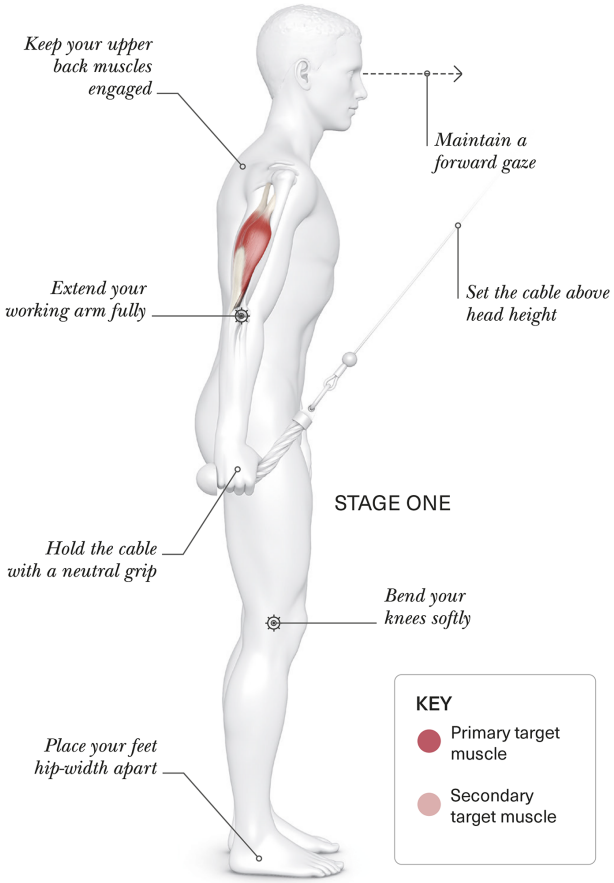
Stand tall with your hips flexed slightly to bring your upper body closer to the line of resistance. Hold the cable with a neutral grip, arm flexed.

STAGE ONE

Breathe in to engage your core, then breathe out as you extend your working arm fully. Your arm path should follow the line of resistance of the cable.

STAGE TWO

Breathe out as you return your arm to the starting position, keeping the movement controlled. Repeat stages 1 and 2, then work your other side.



Double-tap image to read the labels

CROSS-CABLE TRICEPS PRESSDOWN

Another option is to use two cables to train the triceps on both sides simultaneously. Place tension in your upper back to help prevent your shoulders from rounding.

PREPARATORY STAGE

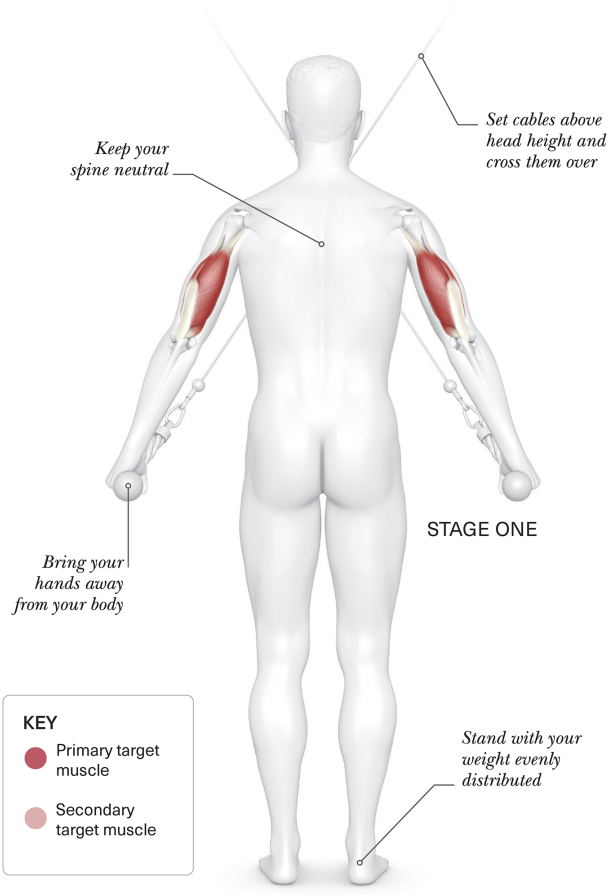
Stand tall with your feet hip-width apart and hips flexed slighlty. Hold a cable in each hand with a neutral grip, and your elbows flexed.

STAGE ONE

Breathe in to brace your core. Breathe out to extend your arms down, following the lines of resistance formed by the cables.

STAGE TWO

Breathe out to flex your elbows, bringing your arms back up to the starting position in a smooth, even movement. Repeat stages 1 and 2.



Double-tap image to read the labels

ABDOMINAL EXERCISES

The main muscles responsible for movement in the abdominals are: the rectus abdominis (the “six pack” muscle); the external obliques and the internal obliques, both positioned at the sides of the torso; and the transverse abdominis, the deepest abdominal muscle.

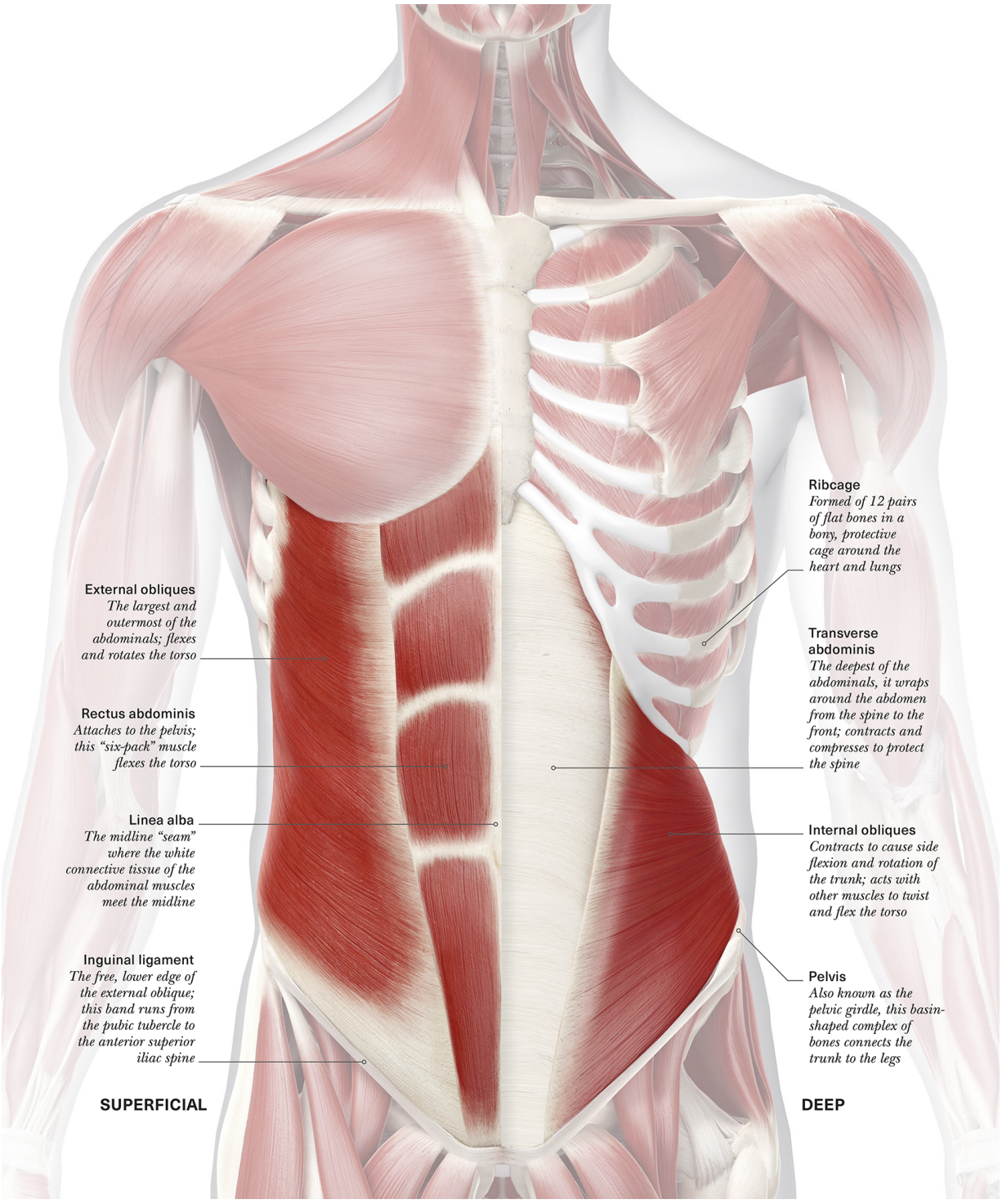
The rectus abdominis (or RA) attaches to the sternum and the connective tissue of the ribs and pelvis. Both the external and the internal obliques attach to the ribs, pelvis, and linea alba – an area of connective tissue at the midline of the abdominal wall. The transverse abdominis (or TVA) attaches to the pelvis and the ribs, linea alba, and connective tissue of the lower back.

When flexing the trunk forward, the RA creates this movement but also contributes structural support to other abdominals. It can be trained using bodyweight or load with exercises such as crunches or hanging knee raises.

When flexing the trunk to the side (lateral flexion), your body uses the obliques, which also help in forward flexion and rotation. The obliques also act as anti-rotation and anti-extension contributors for the trunk – keeping the spine safe and protected while adding stability to the torso.

The TVA functions as your internal “lifting belt”, adding compression or cinching forces to stabilize the torso and protect the spine.

All of these muscles also support respiration and provide general strength and structure to the torso.



Double-tap image to read the labels

SUPERFICIAL

External obliques
The largest and outermost of the abdominals; flexes and rotates the torso

Rectus abdominis
Attaches to the pelvis; this "six-pack" muscle flexes the torso

Linea alba
The midline "seam" where the white connective tissue of the abdominal muscles meet the midline

Inguinal ligament
The free, lower edge of the external oblique; this band runs from the pubic tubercle to the anterior superior iliac spine

DEEP

Ribcage
Formed of 12 pairs of flat bones in a bony, protective cage around the heart and lungs

Transverse abdominis
The deepest of the abdominals, it wraps around the abdomen from the spine to the front; contracts and compresses to protect the spine

Internal obliques
Contracts to cause side flexion and rotation of the trunk; acts with other muscles to twist and flex the torso

Pelvis
Also known as the pelvic girdle, this basin-shaped complex of bones connects the trunk to the legs

“Strong abs lead to ***a healthy core, a protected spine****, and* ***reduced lower-back injury****.”*

SECTION CONTENTS

Front plank with rotation

Side plank with rotation

Transverse abdominal ball crunch

Variations:

- Cat–cow kneeling crunch
- Stir-the-pot Swiss ball
- Deadbug

Hanging knee raise

Variations:

- Cable rope crunch
- Facing-away standing crunch
- Decline abdominal crunch

Cable rotational oblique twist

Variations:

- Oblique twist with plate weight
- Bicycle crunch
- Alternating V-up crunch

FRONT PLANK WITH ROTATION

Known by many as the "mountain climber", this exercise works multiple muscles – of the legs, core, and arms – at the same time, while also giving you a cardio workout if you up the tempo. The twisting movement strengthens the muscles of the core, especially the oblique muscles.

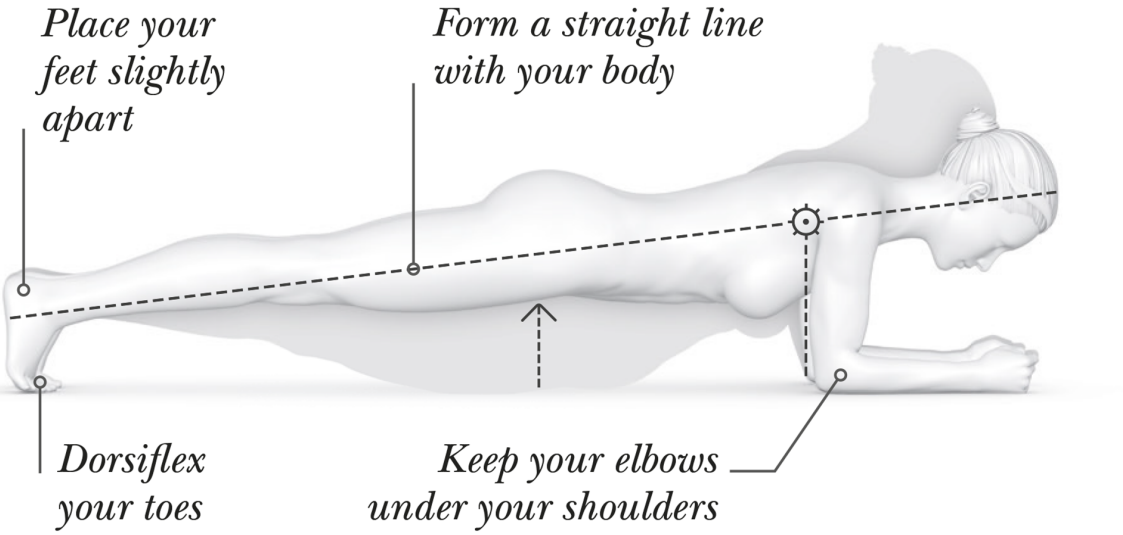
THE BIG PICTURE

For this exercise, you'll need to raise your hips into the plank position and hold your body in this straight line throughout as you twist to each side. By keeping tension through your arms, upper back, torso, and lower body, you help to stabilize your lower back and protect it from injury.

Beginners can start with 4 sets of 8–10 reps; discover other targeted sets in the training programmes. If you find this exercise too difficult, try holding the starting plank position without rotating.

PREPARATORY STAGE

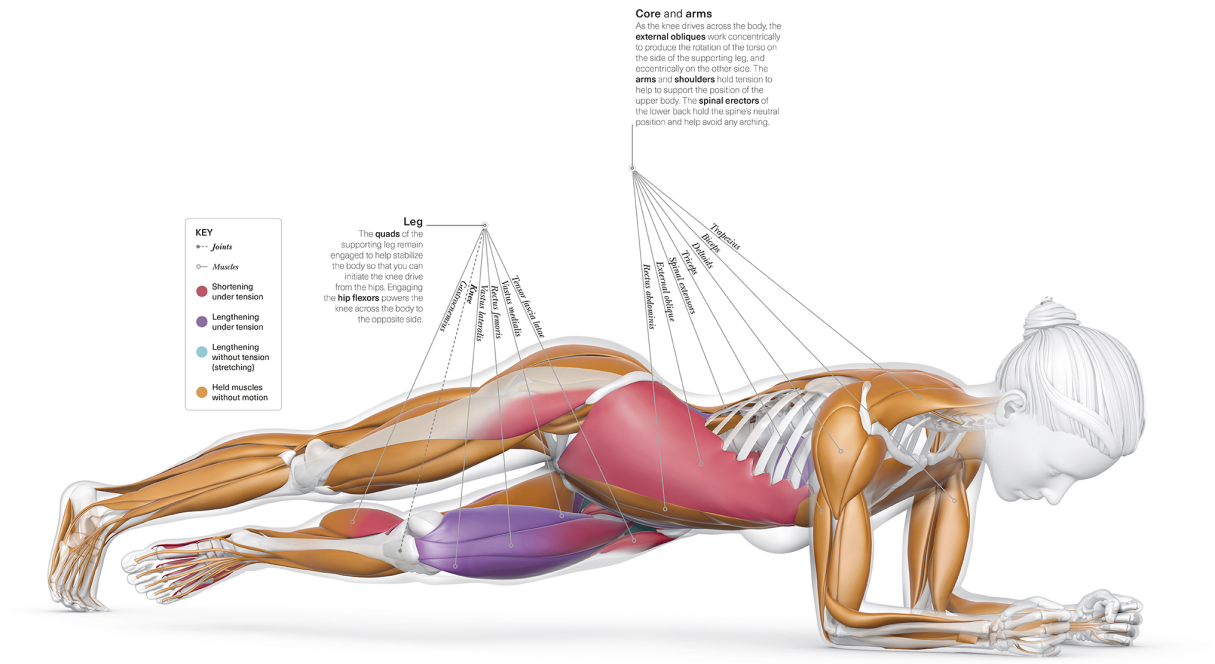
Lie on the floor in a prone position with your upper body supported by your forearms. To get into the starting position, raise your hips up to form a straight line from your head down to the ankle.



Double-tap image to read the labels

STAGE ONE

Breathe out. From the plank position, raise one foot while flexing at the knee and track that foot across the body to the opposite side. When you have rotated as far as you can, return to the plank. Keep your core engaged and a neutral spine throughout.



Double-tap image to read the labels

ANTERIOR-LATERAL VIEW

Core and **arms**

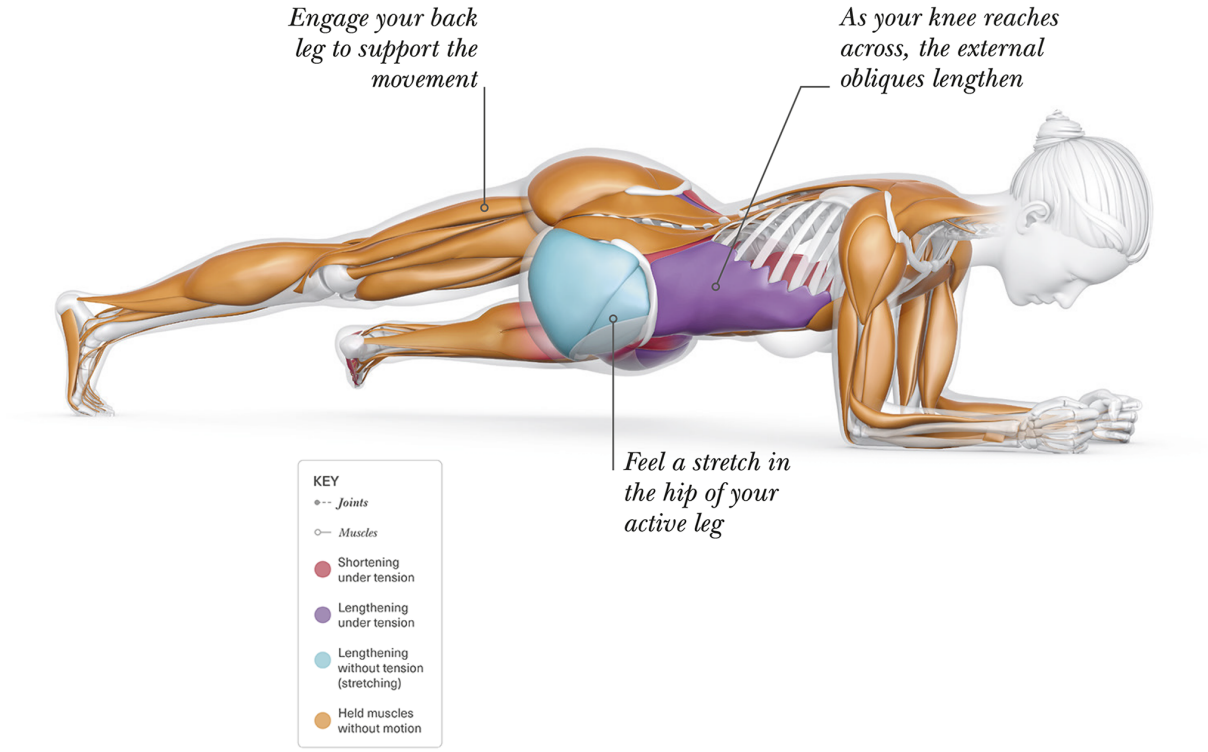
As the knee drives across the body, the **external obliques** work concentrically to produce the rotation of the torso on the side of the supporting leg, and eccentrically on the other side. The **arms** and **shoulders** hold tension to help to support the position of the upper body. The **spinal erectors** of the lower back hold the spine's neutral position and help avoid any arching.

Leg

The **quads** of the supporting leg remain engaged to help stabilize the body so that you can initiate the knee drive from the hips. Engaging the **hip flexors** powers the knee across the body to the opposite side.

STAGE TWO

Breathe in as you reset your position. Repeat stages 1 and 2 for the desired number of reps, then return your hips to the floor in the prone position. Then, to work evenly, perform an equal number of reps on the opposite leg.



ℹ Double-tap image to read the labels

Common mistakes

Don’t let your neck jut forward; keep your eyes fixed on the floor and a neutral head position. Be sure to keep your shoulders over your elbows.

SIDE PLANK WITH ROTATION

This easy-to-do-at-home exercise strengthens the core and tones the waistline by working the muscles at the sides of the torso – the obliques. Be sure to breathe slowly throughout, and exercise one side and then the other.

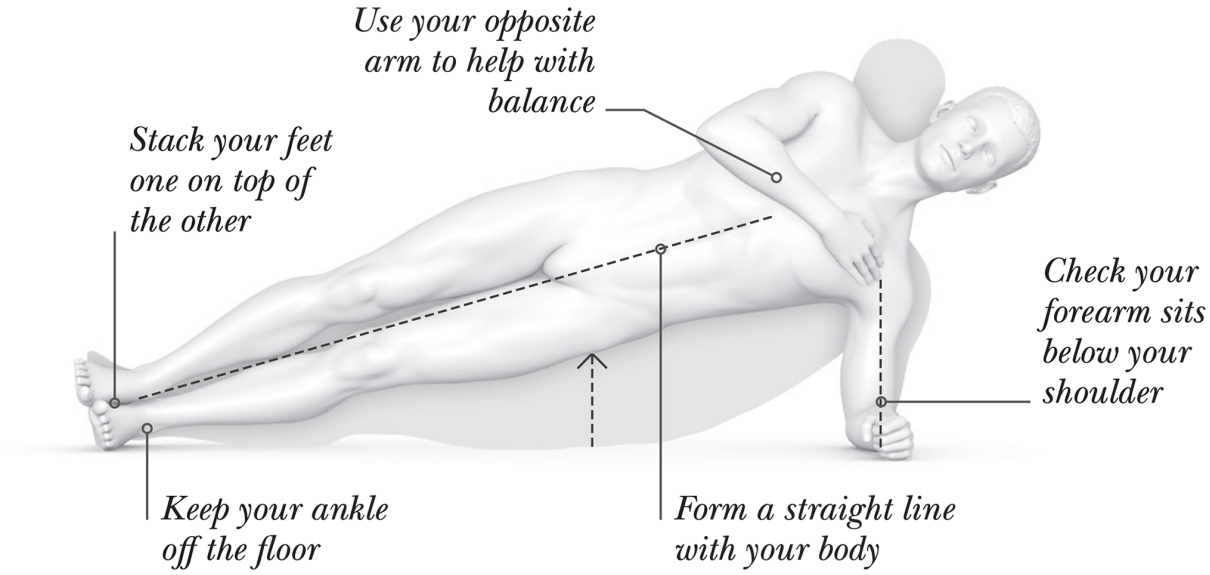
THE BIG PICTURE

As with the front plank, your body is held in a straight line with abdominal muscles engaged throughout, but this time you're positioned on alternating sides. Keep your knees and chest facing forward throughout; rotate only from your hips.

Beginners can start with 4 sets of 8–10 reps; discover other targeted sets in the training programmes.

PREPARATORY STAGE

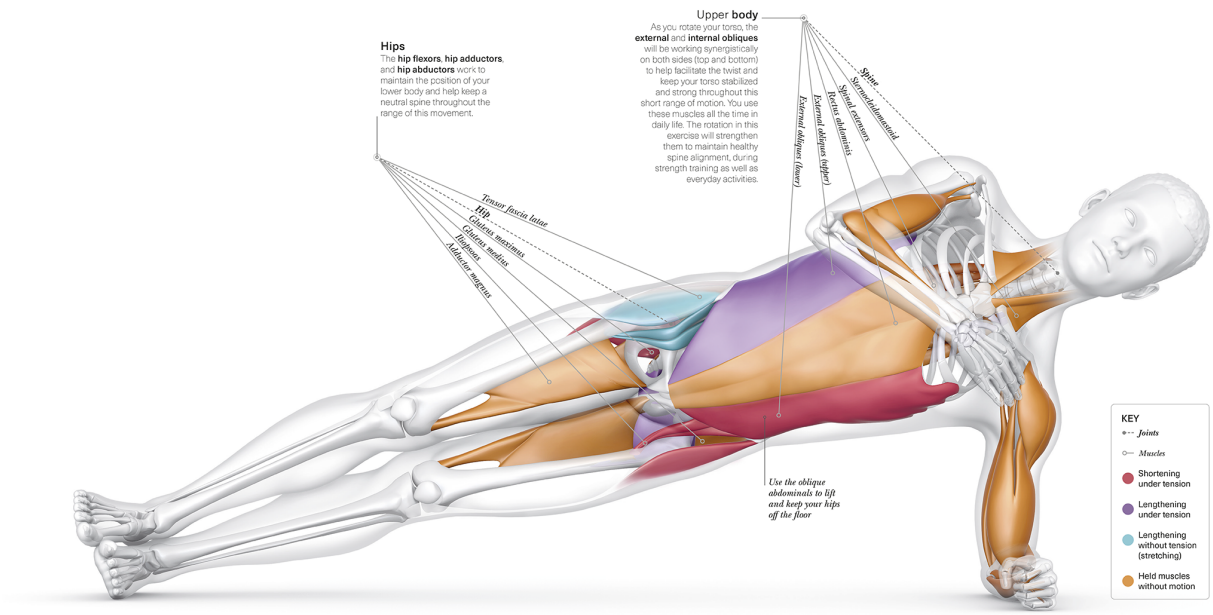
Lie on one side with your feet stacked together and your upper body supported on your lower forearm. Fold your other arm across your chest. Lift your hips off the floor, holding a straight line from your head to your ankle.



Double-tap image to read the labels

STAGE ONE

Rotate your hips down toward the floor; be sure to keep your chest facing forward and rotate only at the hips. Twist only as far as you can go without moving at the chest and knee.



ℹ Double-tap image to read the labels

ANTERIOR VIEW

Hips

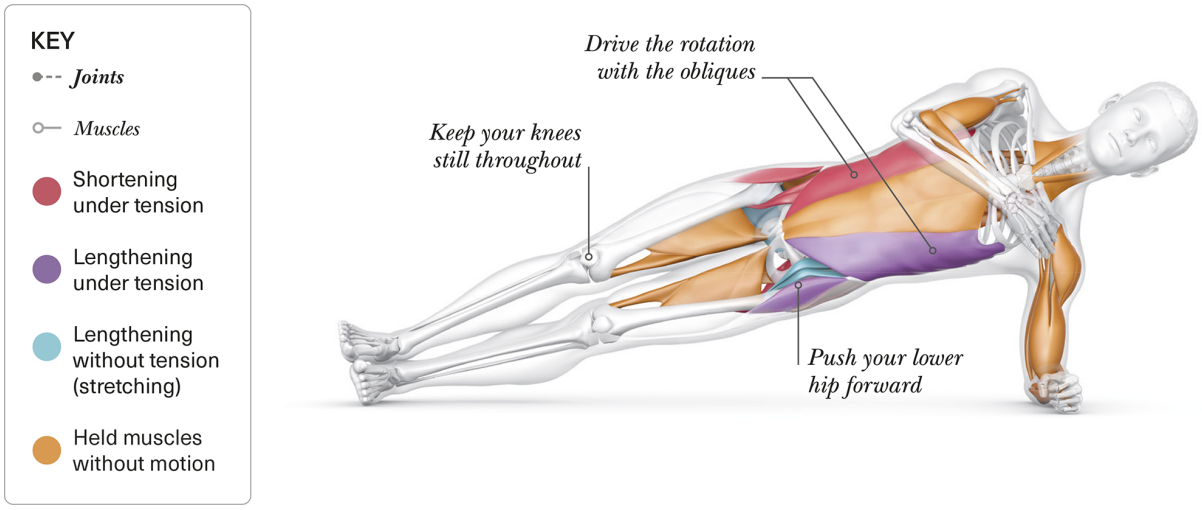
The **hip flexors**, **hip adductors**, and **hip abductors** work to maintain the position of your lower body and help keep a neutral spine throughout the range of this movement.

Upper **body**

As you rotate your torso, the **external** and **internal obliques** will be working synergistically on both sides (top and bottom) to help facilitate the twist and keep your torso stabilized and strong throughout this short range of motion. You use these muscles all the time in daily life. The rotation in this exercise will strengthen them to maintain healthy spine alignment, during strength training as well as everyday activities.

STAGE TWO

Return your hips to the starting position, keeping your chest facing forward. Next, rotate your hips toward the ceiling, and then back to the starting position. Repeat stages 1 and 2. Repeat on the other side.



Double-tap image to read the labels

Common mistakes

Incorrect body set-up (alignment is crucial) and sagging hips won't help you achieve tension from head to toe. Work to keep your hips off the floor.

TRANSVERSE ABDOMINAL BALL CRUNCH

This exercise safely trains the core, targeting the transverse and rectus abdominal muscles; the transversus abdominis (often shortened to TVA) is a deep muscle whereas the rectus abdominis is the “six-pack” muscle nearer the surface.

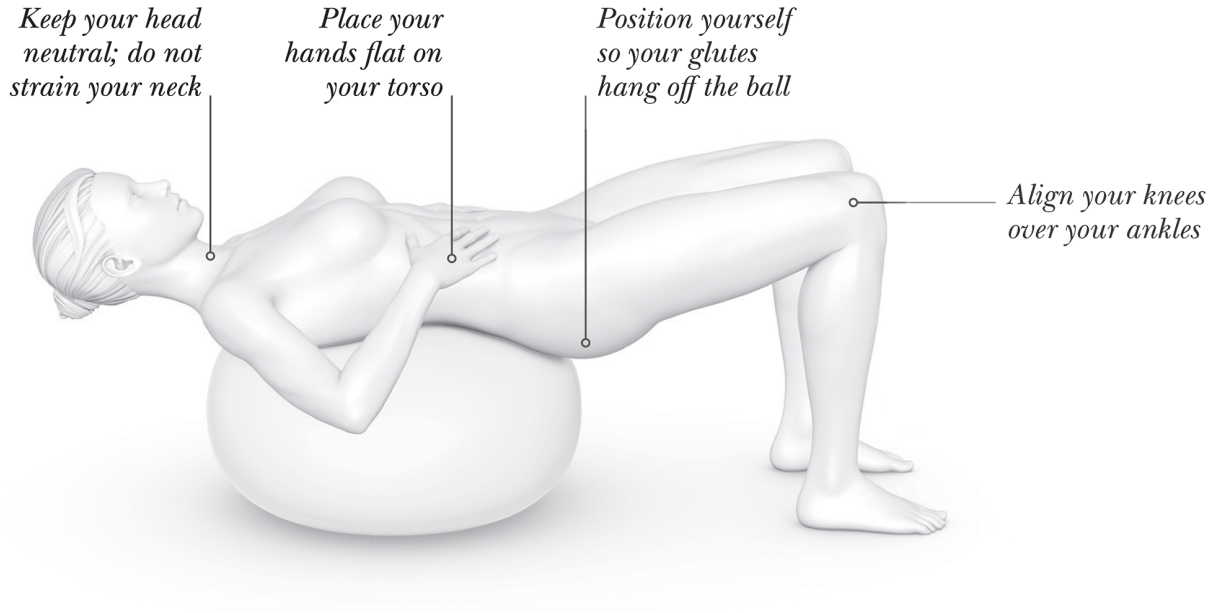
THE BIG PICTURE

You’ll need an exercise ball with a diameter of at least 55–65cm (21½–26in) for this abdominal crunch – a movement that involves lifting and lowering the upper body using the muscles of the core. You will feel your abdominal muscles compress and flex beneath your hands as you perform the movement.

Beginners can start with 4 sets of 8–10 reps; discover other variations on and other targeted sets in the training programmes.

PREPARATORY STAGE

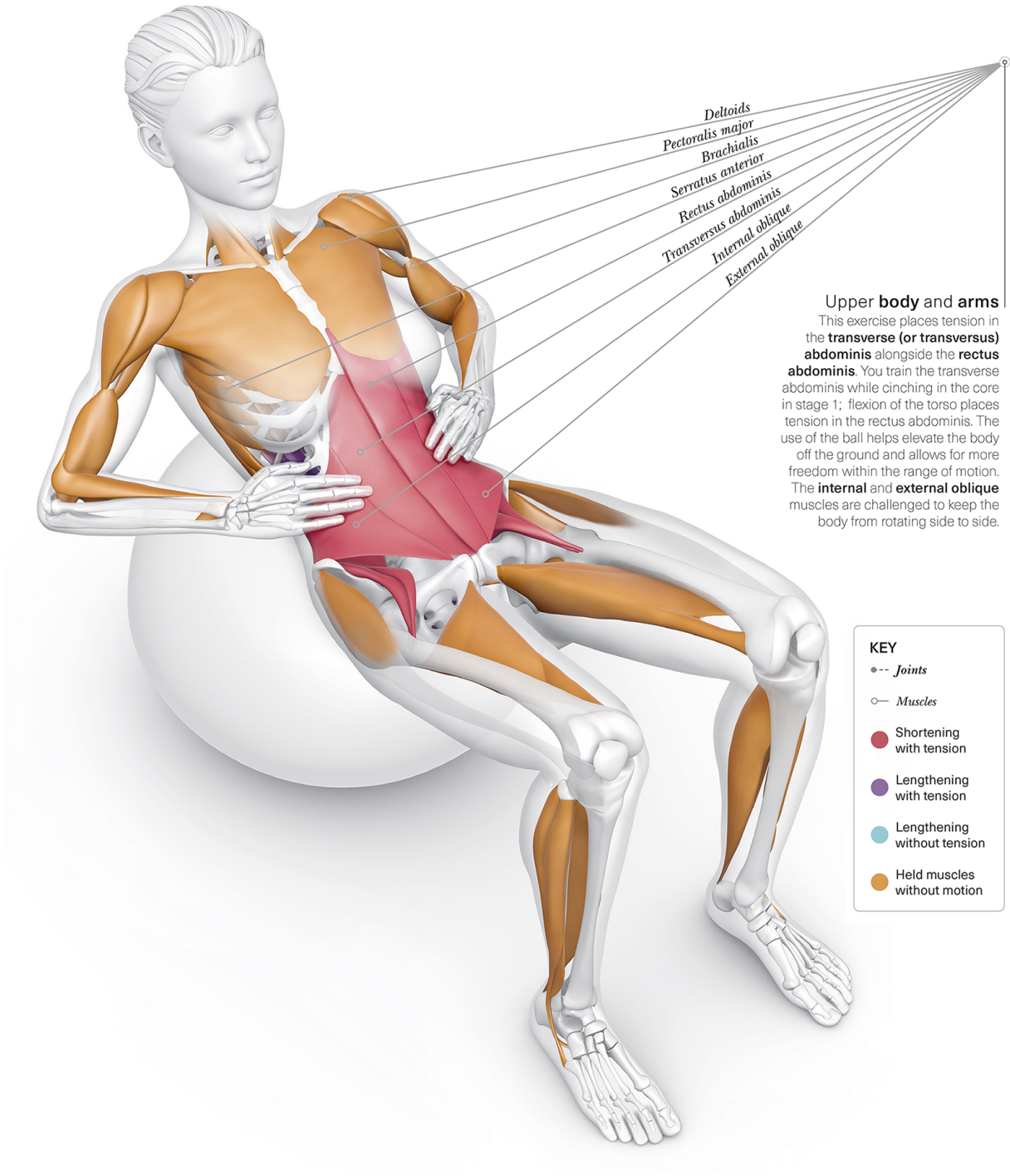
Sit on top of the ball, with your feet shoulder-width apart and flat on the floor. Walk your feet out so that only the lower part of your back is in contact with the ball, then lower your upper body so that you adopt a supine position.



Double-tap image to read the labels

STAGE ONE

Take a breath in and engage your abdominals to help stabilize your core. Start the crunching motion by using your abs to flex at the spine as you breathe out; imagine “cinching in” your waist as you crunch. Once the abs are fully flexed and you’ve exhaled, that is the end of the range of motion. Do not flex further at the hips to bring the torso upward. To add challenge, hold at the top position for 1 second.



ℹ Double-tap image to read the labels

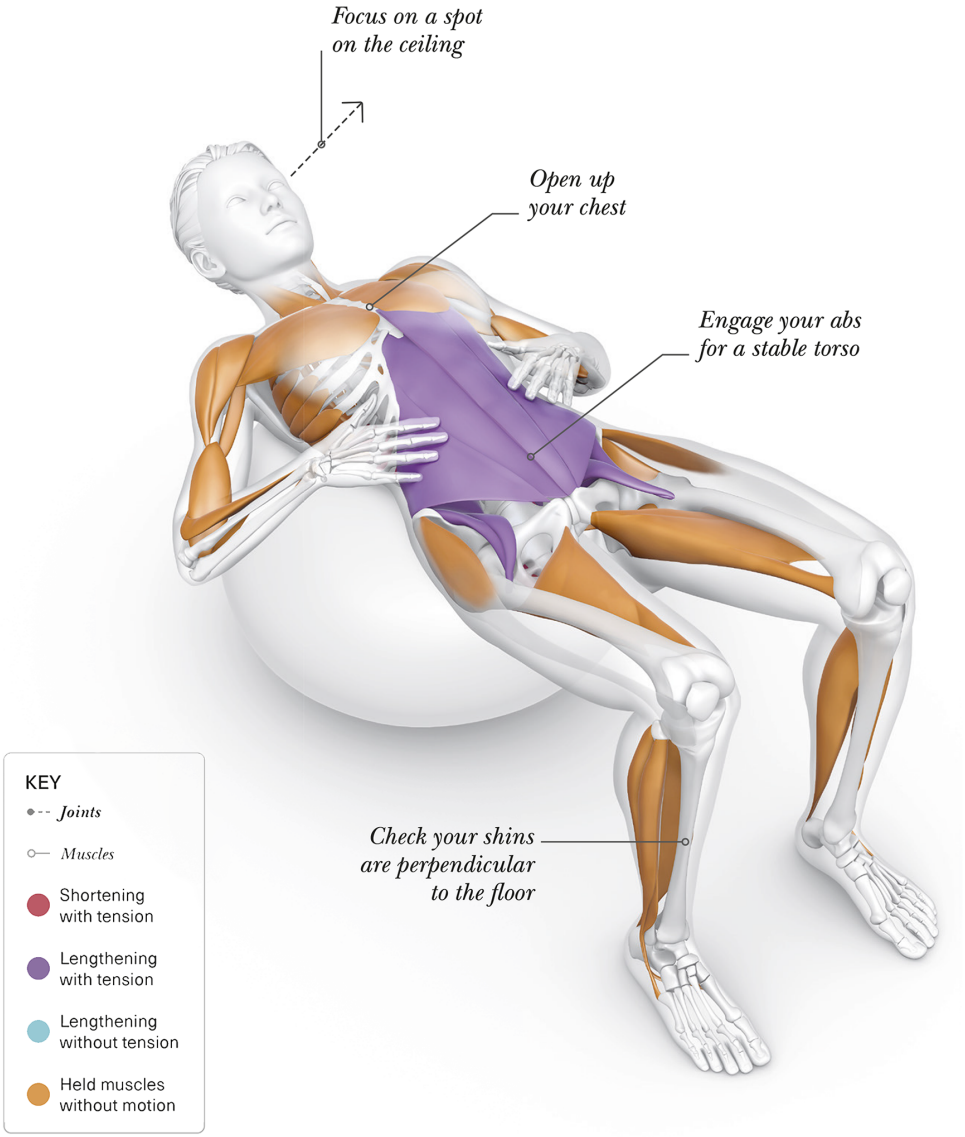
SUPERIOR-ANTERIOR-LATERAL VIEW

Upper **body** and **arms**

This exercise places tension in the **transverse (or transversus) abdominis** alongside the **rectus abdominis**. You train the transverse abdominis while cinching in the core in stage 1; flexion of the torso places tension in the rectus abdominis. The use of the ball helps elevate the body off the ground and allows for more freedom within the range of motion. The **internal** and **external oblique** muscles are challenged to keep the body from rotating side to side.

STAGE TWO

While maintaining stability in your core, breathe in as you start to extend at the spine and expand your midsection under control, returning to the starting position. Reset your breathing and then repeat stages 1 and 2.



Double-tap image to read the labels

Common mistakes

Not following the breathing correctly during this exercise can limit the effectiveness of the movement in challenging the core, and shift tension elsewhere. To prevent injury and to get the most out of the movement, control your breathing.

VARIATIONS

These exercises all target the abdominal muscles, including the transverse abdominis (TVA) and rectus abdominis (RA). Focus on core engagement and breathing control, rather than speed.

CAT–COW KNEELING CRUNCH

Commonly referred to as “cat-cow”, this yoga-inspired exercise targets muscles of the upper body – including those in the arms, shoulders, and back – as well as training the abdominals.

PREPARATORY STAGE (COW)

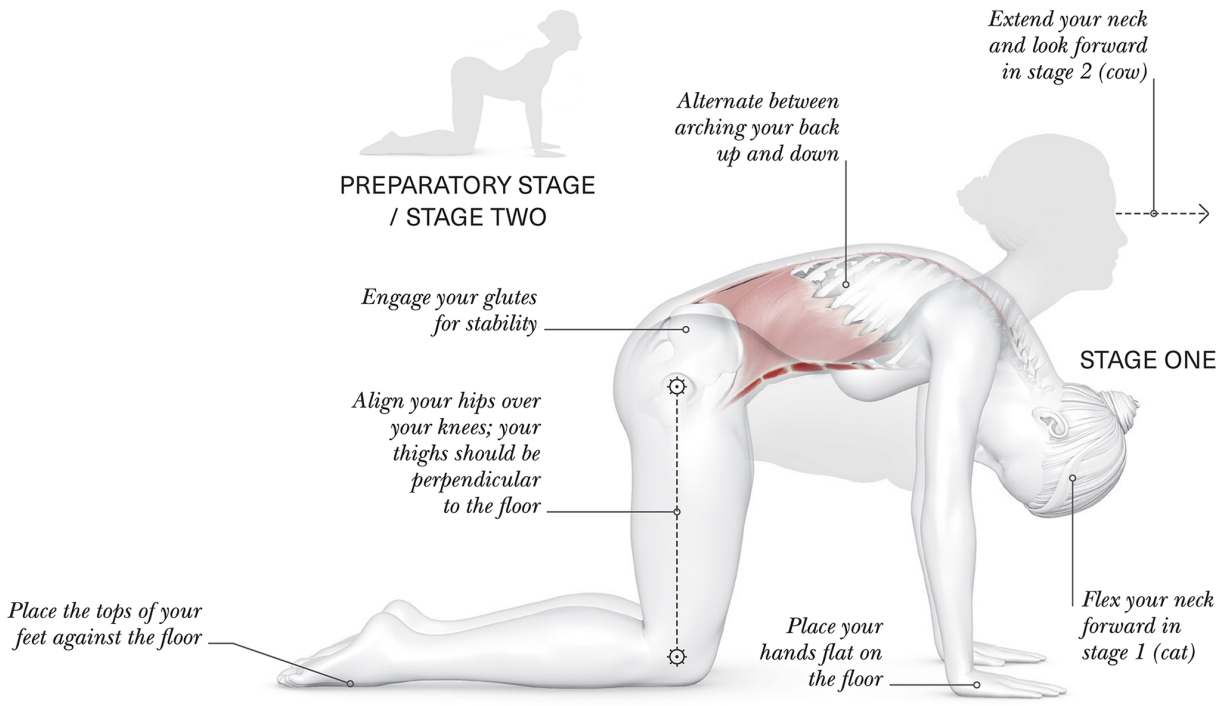
Kneel with your knees and feet aligned, hip-width apart. Your shins should be in contact with the floor. Place your hands on the floor beneath your shoulders.

STAGE ONE (CAT)

Breathe in to brace your core. As you breathe out, engage your TVA to lift your waist and flex at your spine using your rectus abdominis, so your back arches.

STAGE TWO (COW)

Breathe in to lower your back; contract your spinal erectors and upper-back muscles to open up your chest and lengthen your abs. Repeat stages 1 and 2.



Double-tap image to read the labels

STIR-THE-POT SWISS BALL

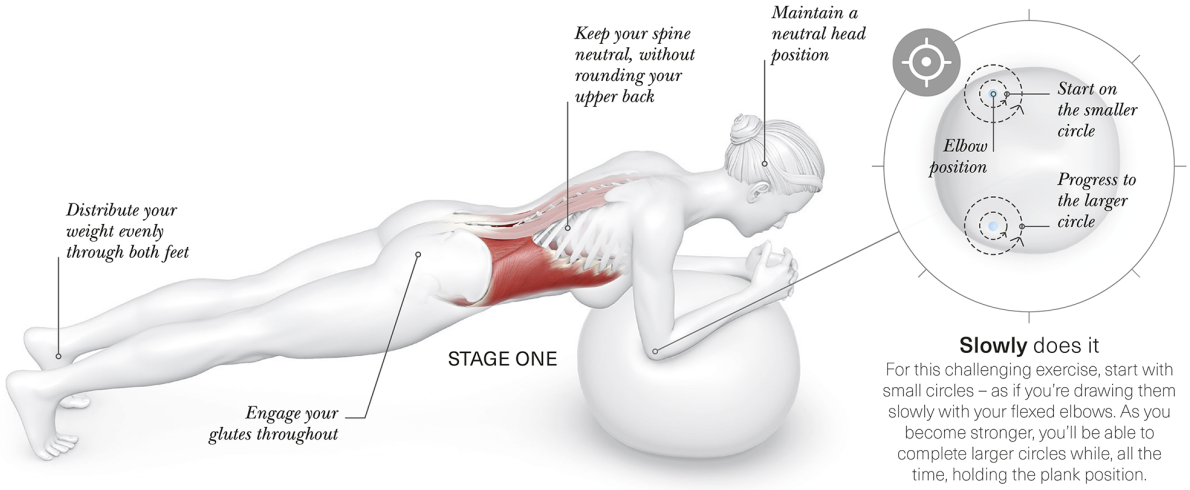
This exercise – so called because it emulates the motion of stirring a cooking pot – builds a connection between your core, hips, and lower back, while strengthening and increasing the endurance of your core and lower back.

PREPARATORY STAGE

Assume the plank position with your feet hip-width apart and your forearms supported securely on a stability ball; elbows are in contact with the ball beneath your shoulders. Engage your abs and glutes and keep your knees extended.

STAGE ONE

Breathing in and out in a controlled manner, move your elbows in small circular motions, pressing down into the ball to guide it. Keep your hips still. Once you have mastered this exercise, you can make it harder by increasing the range of motion.



Double-tap image to read the labels

Slowly does it

For this challenging exercise, start with small circles – as if you're drawing them slowly with your flexed elbows. As you become stronger, you'll be able to complete larger circles while, all the time, holding the plank position.

DEADBUG

This uniquely named abdominal exercise involves the transverse abdominis and rectus abdominis. It also challenges your ability to coordinate movements on both sides of your body while keeping your core engaged and your spine and pelvis neutral; the distance your arms and legs travel out will be determined, and limited, by this ability.

PREPARATORY STAGE

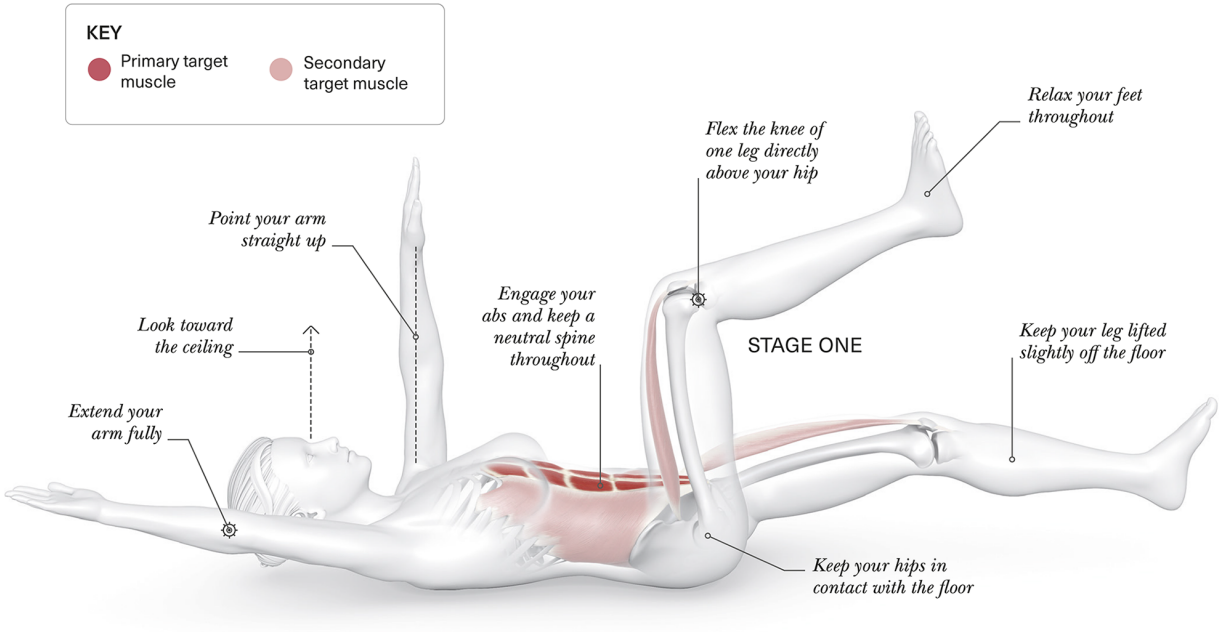
Lie on your back with your arms flexed at the shoulders, legs flexed at the hips and knees, and head lifted off the ground, in a neutral position.

STAGE ONE

Inhale to engage your abs. Exhale as you reach your right arm back and straighten your left leg simultaneously, keeping your hips in contact with the floor.

STAGE TWO

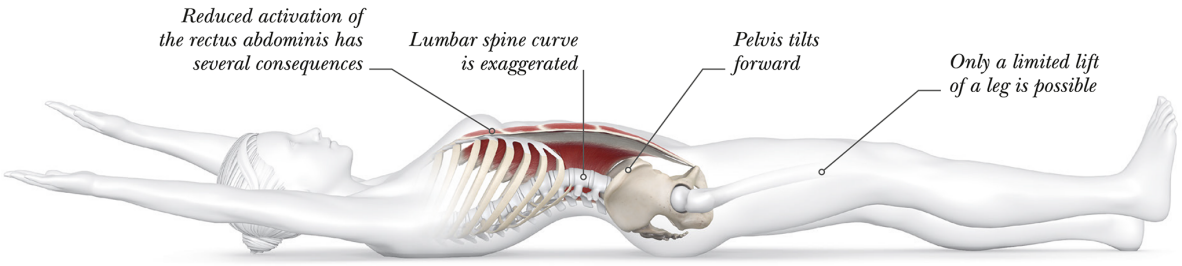
Breathe in to return to the starting position, then flex at the trunk to engage your rectus abdominis. Repeat on the other arm and leg.



Double-tap image to read the labels

The consequences of **not fully activating the abs**

Placing tension in the abs is crucial for creating stability in the pelvis and for protecting your spine during many other movements. In the illustration above, the exerciser struggles to lift a leg because she's not activating her abs and so can't transition to stage 1 of the deadbug exercise, above. Her pelvis starts to tilt forward, creating pelvic instability, and increasing the risk of injury to her lower back.



Double-tap image to read the labels

LATERAL VIEW

HANGING **KNEE RAISE**

Control and coordination of hip and abdomen are trained in this exercise, helping you better connect with your body. The movement targets the hip flexors, alongside the muscles of the rectus abdominis; just lifting your bodyweight is enough to work against.

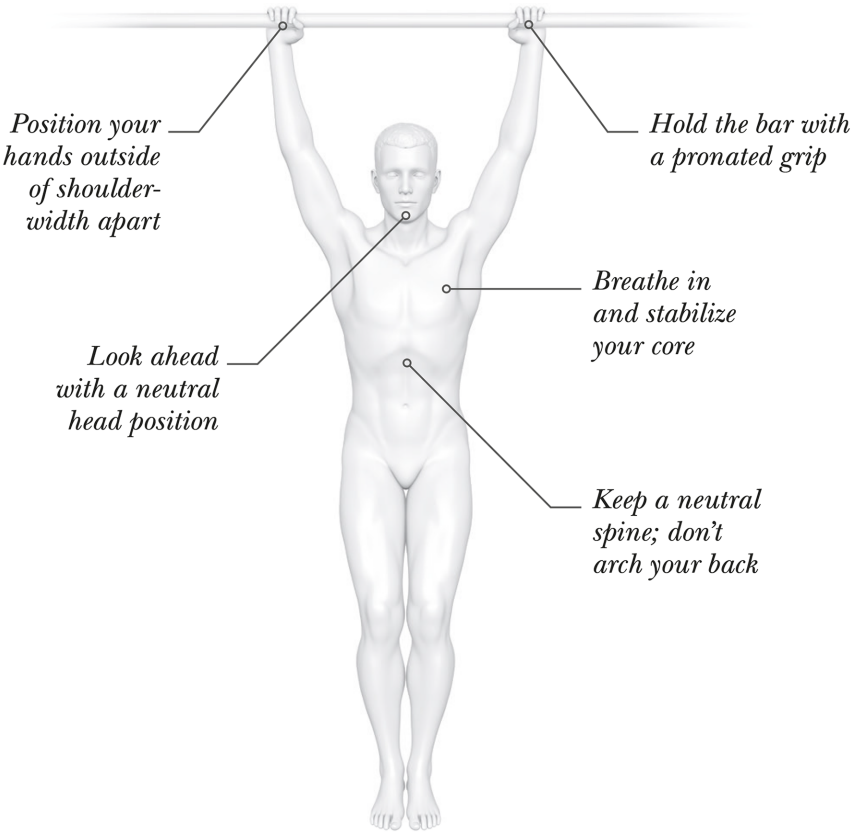
THE **BIG PICTURE**

It may look simple, but this exercise takes practice to achieve. Hanging from a pull-up bar, you isolate muscles in your hip and abdomen to flex your hips and your spine, lifting your knees as high as you can. Tensing your abs before starting neutralizes and stabilizes the spine. Arm straps can offer additional support here, so you can focus on working your abs.

Beginners can start with 4 sets of 8–10 reps; discover other variations on and other targeted sets in the training programmes.

PREPARATORY STAGE

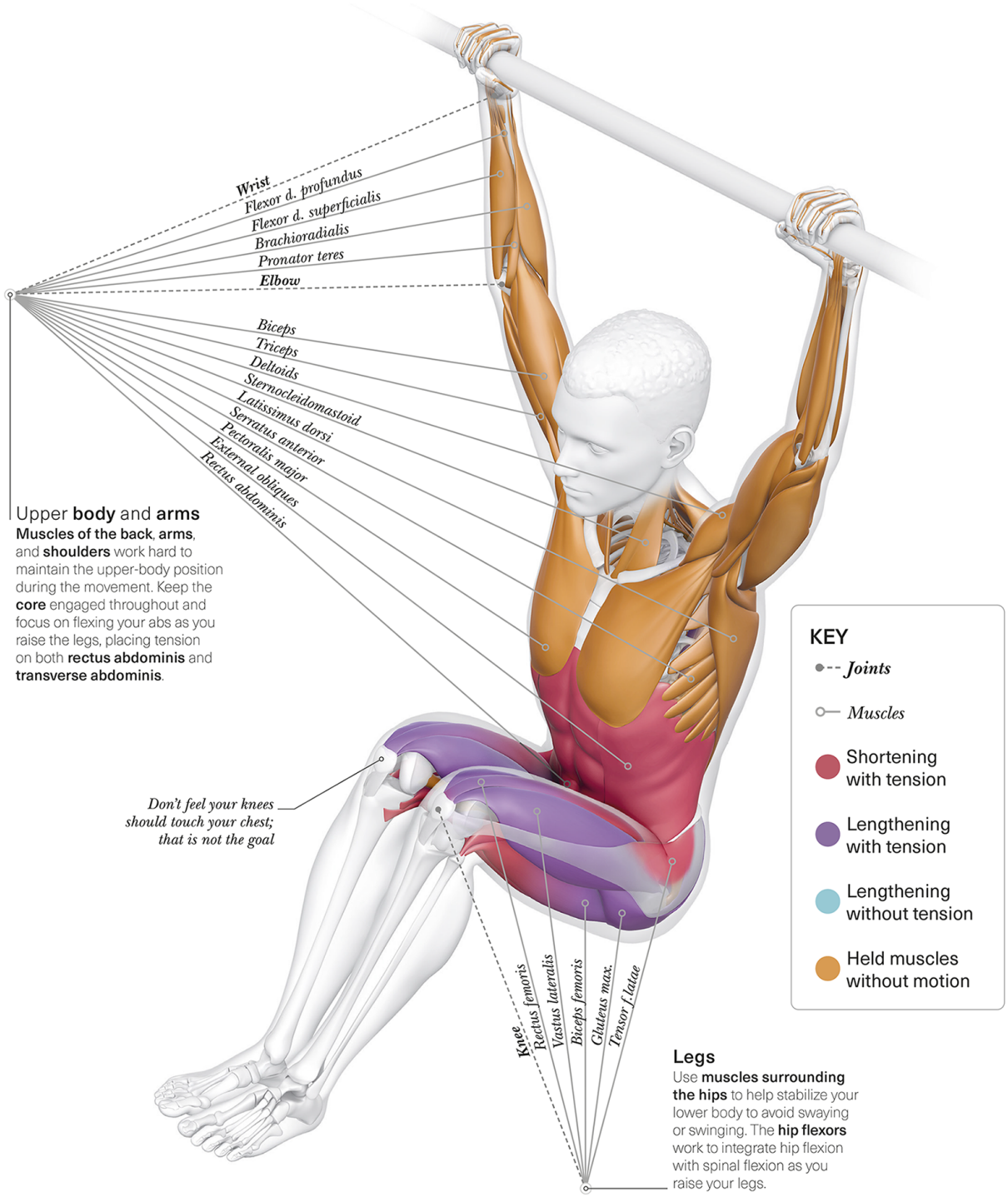
Reach up and grab the bar with a pronated grip, hands outside shoulder-width. Once hanging, breathe in and engage your abs and hip flexors to bring your hips into slight flexion. Your legs should be together, with knees and ankles in line.



Double-tap image to read the labels

STAGE ONE

Breathe out slowly as you raise your knees. Your abs will contract and shorten as you raise and flex at the hip – think to tuck your pelvis under and crunch your abs at the top to bring your knees in. Control the movement; do not swing. For added challenge, hold for 1–2 seconds.



ℹ Double-tap image to read the labels

SUPERIOR-ANTERIOR-LATERAL VIEW

Upper **body** and **arms**

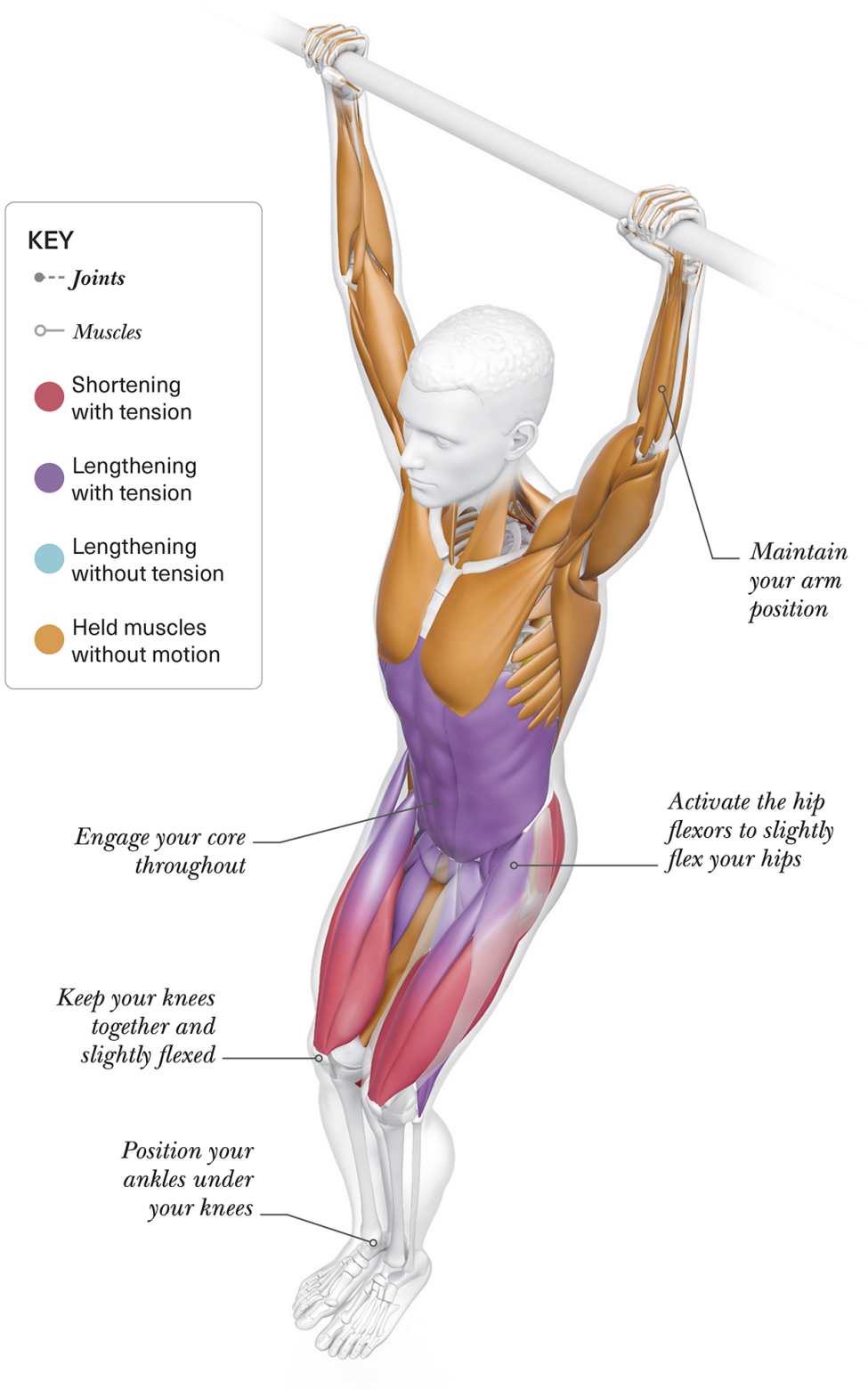
Muscles of the back, **arms**, and **shoulders** work hard to maintain the upper-body position during the movement. Keep the **core** engaged throughout and focus on flexing your abs as you raise the legs, placing tension on both **rectus abdominis** and **transverse abdominis**.

Legs

Use **muscles surrounding the hips** to help stabilize your lower body to avoid swaying or swinging. The **hip flexors** work to integrate hip flexion with spinal flexion as you raise your legs.

STAGE TWO

From the top position, lower your knees back down in a controlled manner, breathing in as you do so, until your reach the starting position. Keep your abs engaged throughout. Reset your breathing and repeat stages 1 and 2.



Double-tap image to read the labels

Common mistakes

Maintaining a controlled tempo (and working with your breathing) is key, since you don't want any swinging. Focus hard on flexing your spine as well as your hips, so your pelvis moves forward and your knees can move up fully. And resist the temptation to pull yourself up with your arms as you lift your legs.

VARIATIONS

These exercises are effective for training the visible ab muscles. A common mistake is to place too much importance on moving from preparatory stage to stage 1. Flex your trunk as you breathe out; once that is achieved, that is the end of your range of motion.

CABLE ROPE CRUNCH

This exercise trains the abs in their most contracted range. Focus on bringing your sternum and pelvis toward each other – your hips will stay fixed while your abs do the work. For added challenge, hold for 1–2 seconds after stage 1.

PREPARATORY STAGE

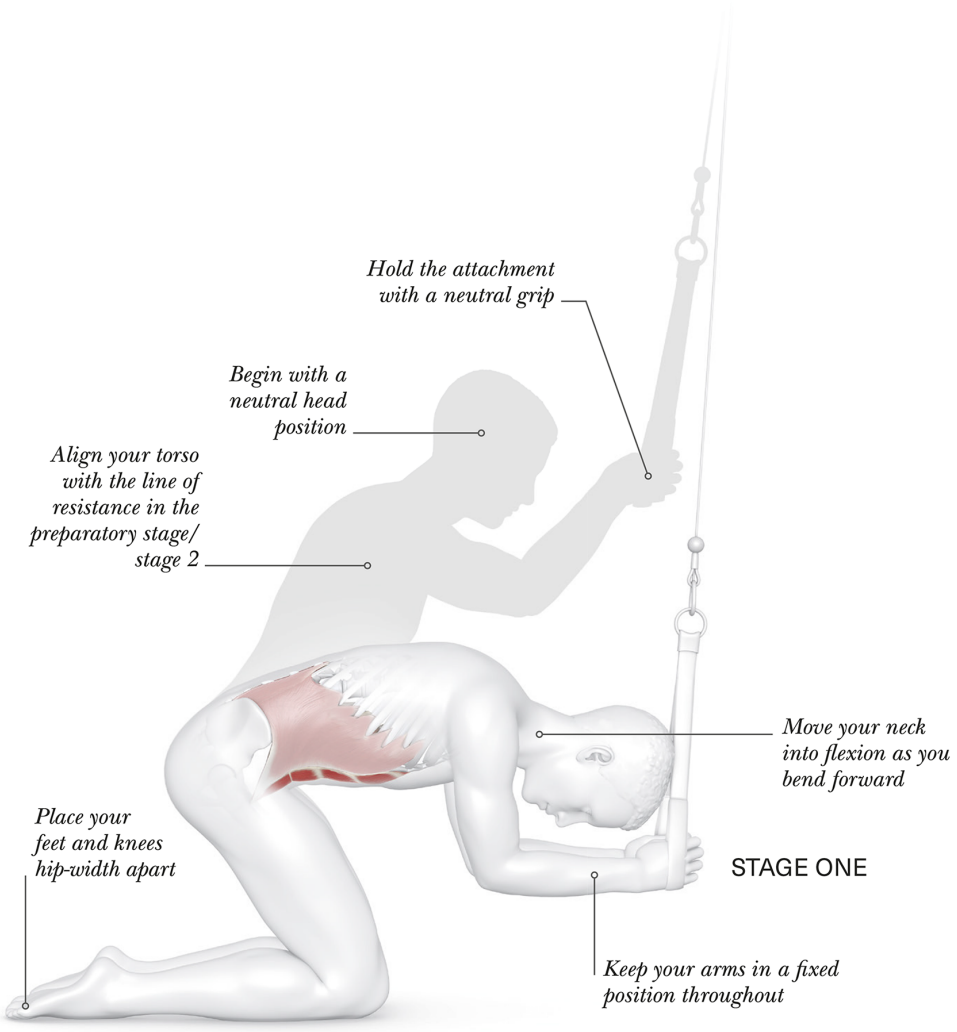
Facing the cable system with a rope, V-bar, or strap attachment in place, take hold of the attachment. Kneel down with your torso leant forward.

STAGE ONE

Breathe in to brace your core. Breathe out as you flex at the trunk, engaging your rectus abdominis. Keep your arms in a fixed position.

STAGE TWO

Breathe in to rise back up; actively contract your spinal erectors to "pull" yourself up, and lengthen your abdominals. Repeat stages 1 and 2.



Double-tap image to read the labels

FACING-AWAY STANDING CRUNCH

Use this variation to target the abs in their lengthened to mid-range. Again, think about bringing your sternum and pelvis toward each other. To increase the challenge, hold for 1–2 seconds after stage 1.

PREPARATORY STAGE

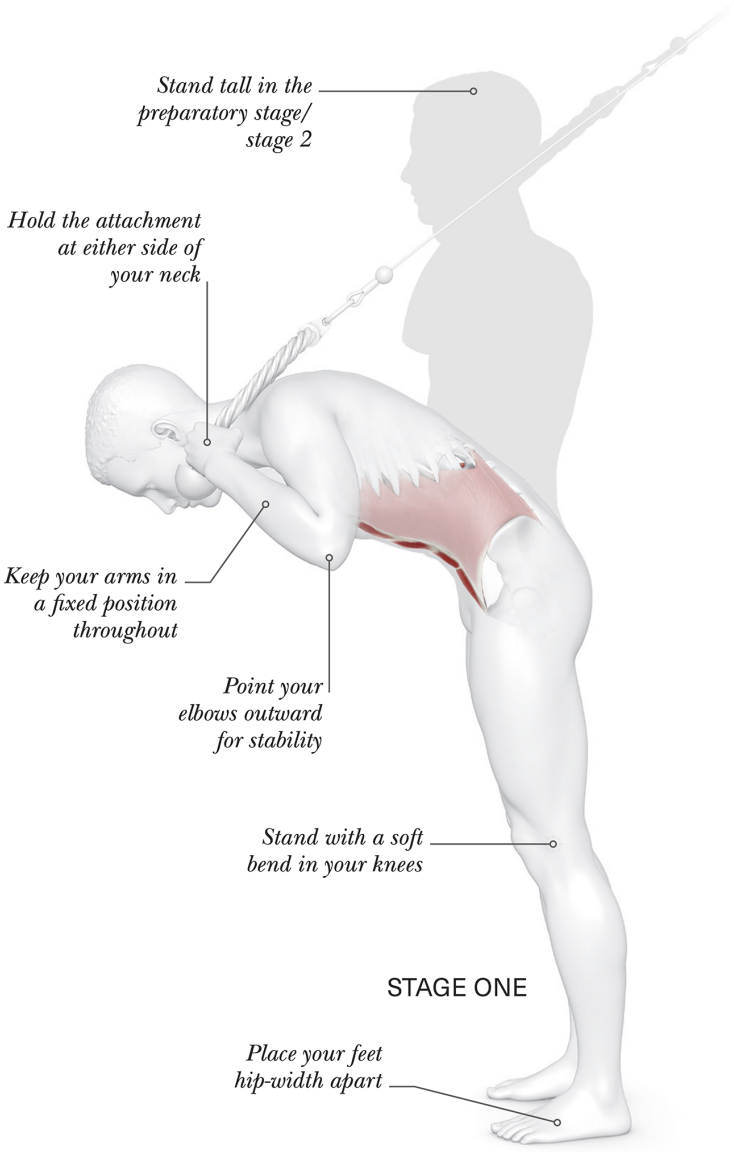
Stand with your back toward the cable system, a rope, V-bar, or strap attachment in place. Hold the attachment with your hands either side of your neck.

STAGE ONE

Breathe in to engage your core, then breathe out as you flex at the trunk, engaging the rectus abdominis and transverse abdominis muscles.

STAGE TWO

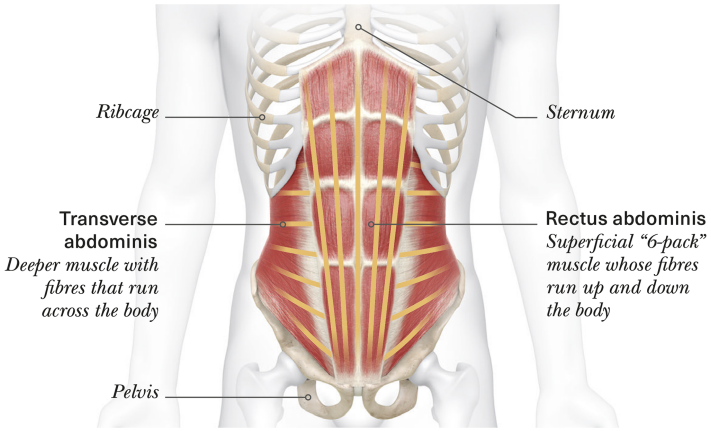
Breathe in as you return to the starting position, contracting your spinal erectors to "pull" yourself up and lengthening your abs. Repeat stages 1 and 2.



ⓘ Double-tap image to read the labels

Muscles of the **core**

Your abdominal muscles help move, control, and support your spine and pelvis. The fibres in each layer of the abs run in varying directions, allowing the core to provide strength and power while withstanding the forces involved in movement in all planes of motion. Together, the core muscles provide stability and mobility for highly coordinated movements in strength training, sport, and everyday life.



Double-tap image to read the labels

Rectus abdominis

Superficial "6-pack" muscle whose fibres run up and down the body

Transverse abdominis

Deeper muscle with fibers that run across the body

DECLINE ABDOMINAL CRUNCH

This variation uses your bodyweight to train the core on a decline bench. Avoid the temptation to generate momentum at the start of the rep and allow that to carry you to the top position; this will take tension away from your abs.

PREPARATORY STAGE

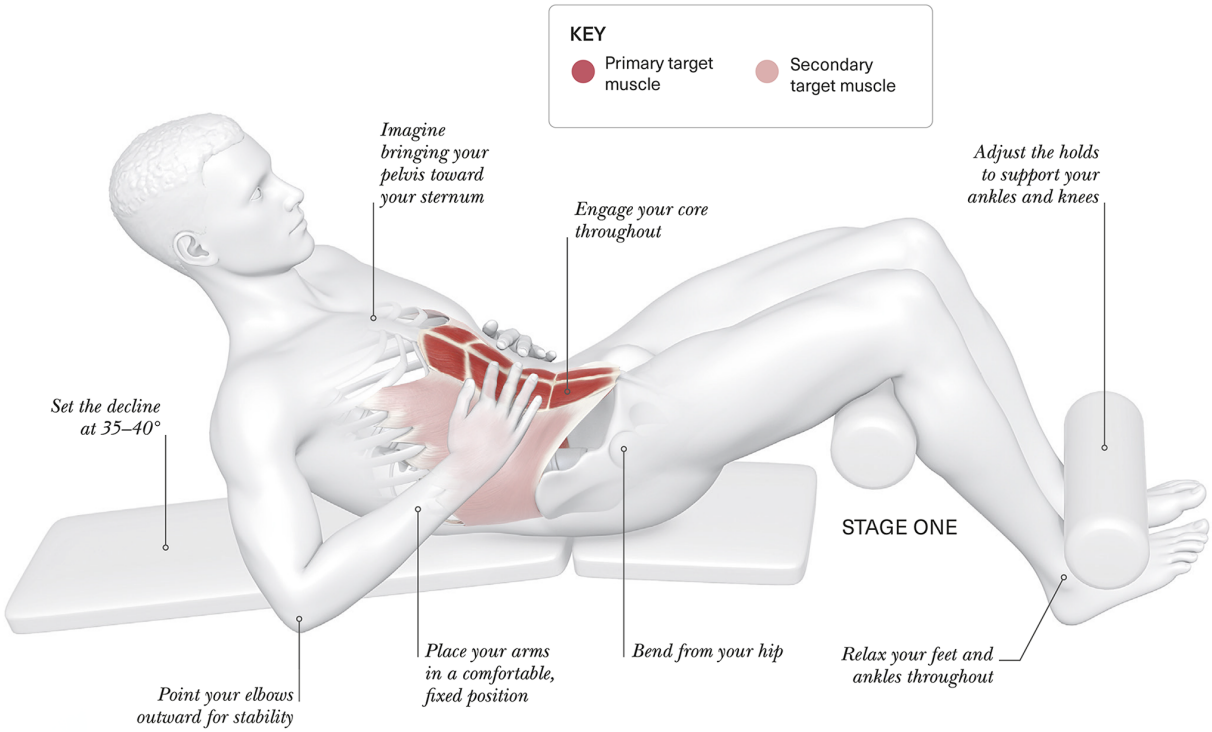
Position yourself on a decline bench with your feet and ankle secure in the foot holds and your hands either on your belly or at the sides of your head.

STAGE ONE

Breathe in to brace your core, then breathe out as you flex at the trunk, crunching upward. Be sure not to pull your head up with your hands.

STAGE TWO

Breathe in to return to the starting position, controlling the eccentric action and keeping tension on your abs. Repeat stages 1 and 2.



Double-tap image to read the labels

CABLE ROTATIONAL **OBLIQUE TWIST**

This twisting exercise trains the internal and external oblique muscles at the sides of the torso. Building strength and endurance in these muscles helps to protect the spine and aids bending and rotating. This movement goes from low to high, but you can go mid-level or high to low.

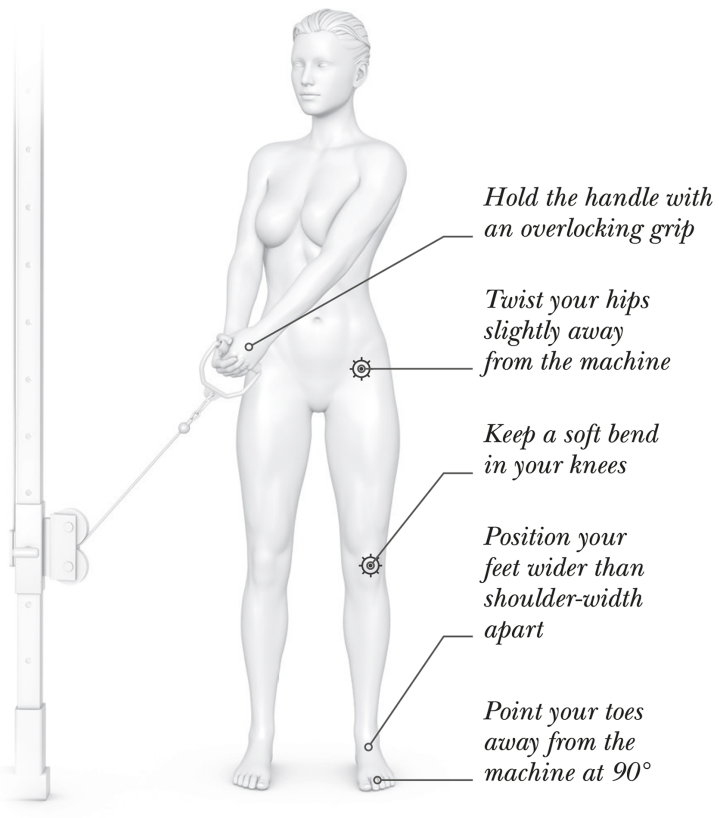
THE **BIG PICTURE**

The low-to-high rotational motion helps build strength in core muscles that, in turn, make everyday activities easier. This version has a more limited range of movement and, consequently, a lower risk of injury compared with others. Set the weights, adjust the height of the cable starting position, and set up a single handle attachment. If you are new to this exercise, use a lighter load and get used to the coordination of the movement across the body.

Beginners can start with 4 sets of 8–10 reps; discover other variations on and other targeted sets in the training programmes.

PREPARATORY STAGE

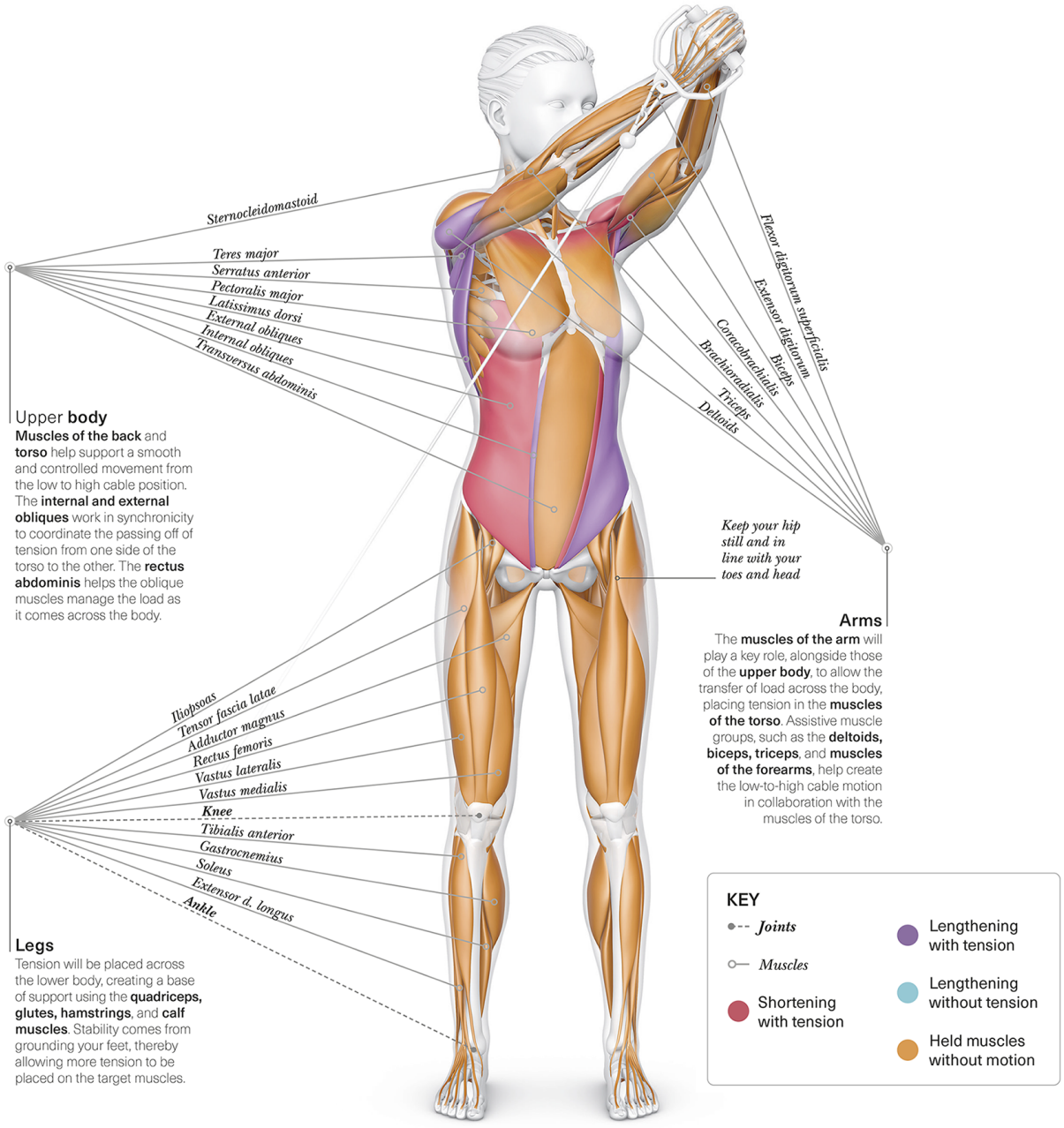
Set up the machine and stand with your right side toward the cable pulley system. Take a wide step to your left and a step back to find a position that allows the cable to move freely. Grab the handle with both hands; the arm near the pulley will bend while the other reaches across your body, which will twist slightly.



Double-tap image to read the labels

STAGE ONE

Begin to breathe out as you start the rotation, keeping your shoulders and upper back stabilized. Use your obliques to twist the handle from your hip across your body toward the opposite shoulder. Be sure to move slowly and in a controlled manner throughout.



Double-tap image to read the labels

ANTERIOR VIEW

Arms

The **muscles of the arm** will play a key role, alongside those of the **upper body**, to allow the transfer of load across the body, placing tension in the **muscles of the torso**. Assistive muscle groups, such as the **deltoids, biceps, triceps**, and **muscles of the forearms**, help create the low-to-high cable motion in collaboration with the muscles of the torso.

Upper **body**

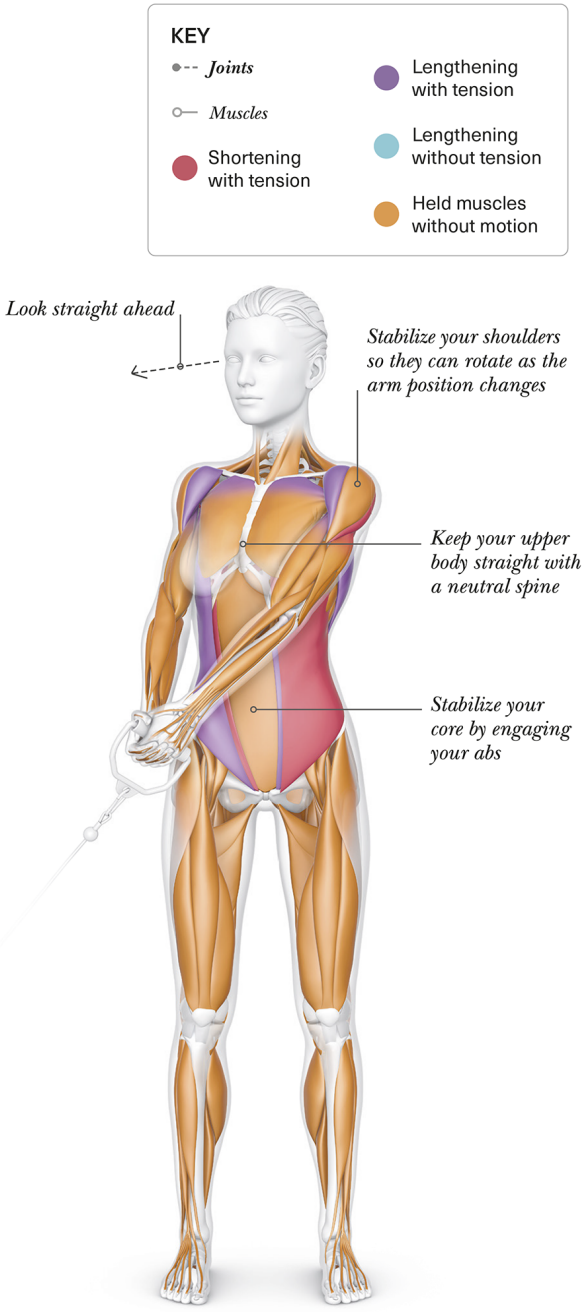
Muscles of the back and **torso** help support a smooth and controlled movement from the low to high cable position. The **internal and external obliques** work in synchronicity to coordinate the passing off of tension from one side of the torso to the other. The **rectus abdominis** helps the oblique muscles manage the load as it comes across the body.

Legs

Tension will be placed across the lower body, creating a base of support using the **quadriceps, glutes, hamstrings**, and **calf muscles**. Stability comes from grounding your feet, thereby allowing more tension to be placed on the target muscles.

STAGE TWO

Keeping your core, upper back, and shoulders stable, breathe in as you resist the load with your abs and return to the starting position. Reset your breathing and repeat stages 1 and 2. Then, turn 180° and repeat on the other side.



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VARIATIONS

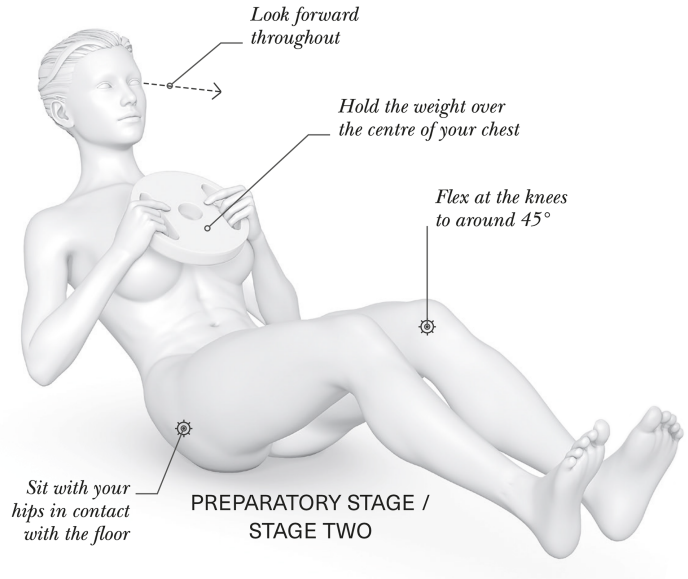
These rotational-crunch abdominal variations involve all the abs – transverse abdominis, rectus abdominis, and the internal and external obliques. When performing these variations make sure to train both sides of your body evenly. Focus on your breathing, and ensure both the lowering and rotation phases of each exercise are smooth and controlled.

OBLIQUE TWIST WITH PLATE WEIGHT

The internal and external obliques are the principal muscles used here, with the abdominals providing stability. You can increase the challenge of the exercise by keeping your legs lifted off the ground throughout the set.

PREPARATORY STAGE

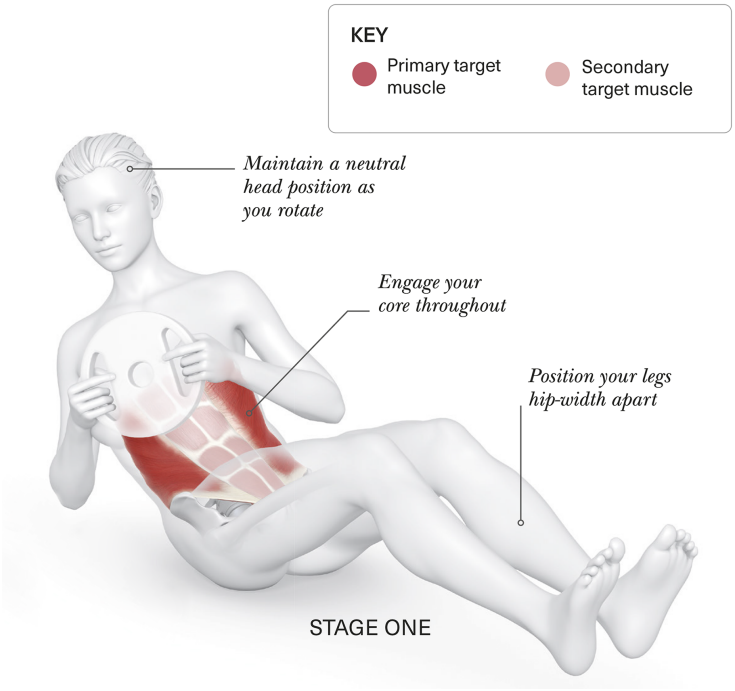
In a seated position, lean back and flex your legs at the hips and knees to form a V-shape between your torso and your thighs. Hold the weight over your chest.



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STAGE ONE

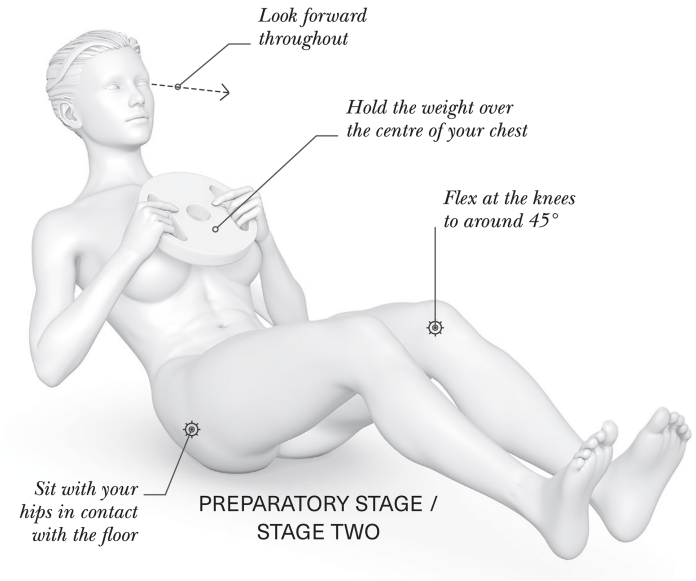
Breathe in to engage your core, then breathe out as you rotate your upper body to one side, holding your legs still and maintaining tension in your core.



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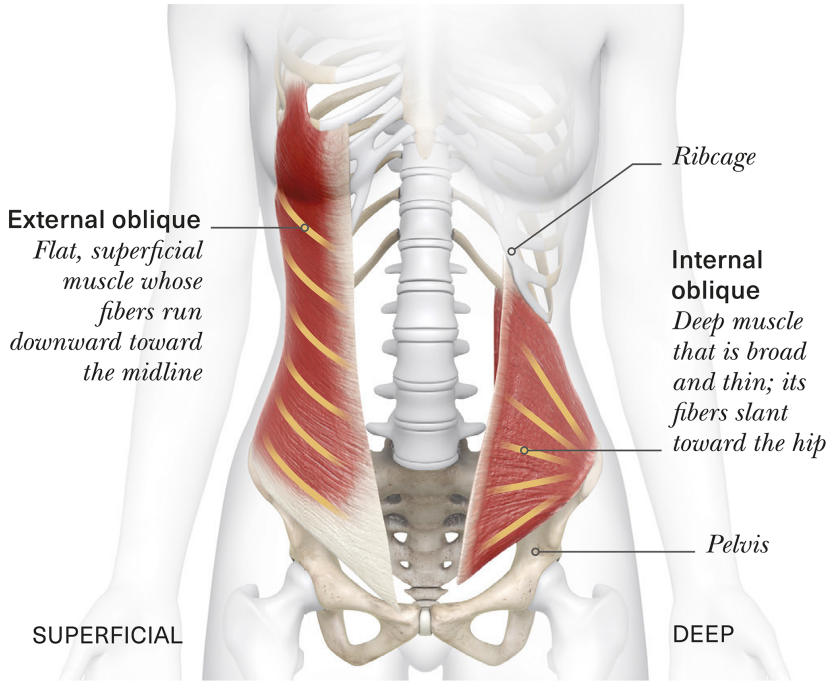
STAGE TWO

Breathe in to return to the starting position, with control. Repeat stages 1 and 2 rotating to the other side, then perform desired reps, alternating sides.


Look forward throughout
Hold the weight over the centre of your chest
Flex at the knees to around 45°
Sit with your hips in contact with the floor
PREPARATORY STAGE / STAGE TWO

Internal and **external obliques**

With their muscle fibres running perpendicular to one another, the internal and external obliques work synergistically across the torso to generate the rotational component of this movement.



Double-tap image to read the labels

External oblique

Flat, superficial muscle whose fibres run downward toward the midline

Internal oblique

Deep muscle that is broad and thin; its fibres slant toward the hip

BICYCLE CRUNCH

This variation, which mimics the motions of a cyclist, is an accessible alternative to the more challenging alternating V-up crunch, below. To increase the difficulty, hold for 1 second at the top position, and keep both legs raised throughout the set.

PREPARATORY STAGE

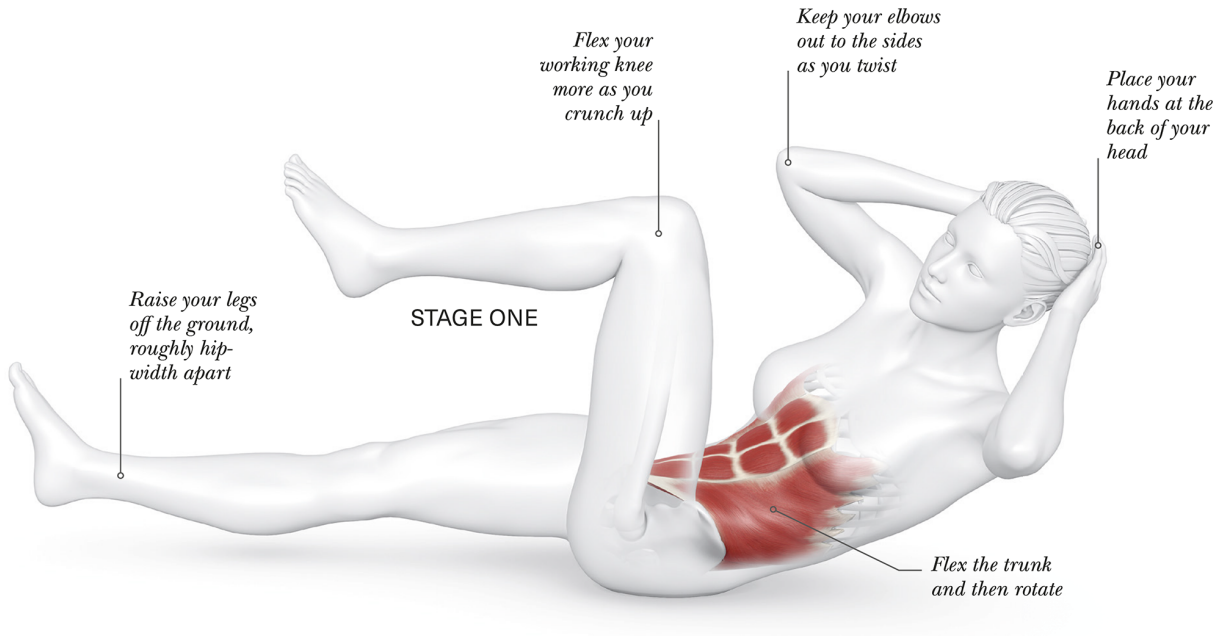
Lie flat on your back with your hands positioned behind your head, and your legs slightly flexed at the hips and knees. Lift your head off the ground slightly.

STAGE ONE

Inhale to engage your core. Breathe out to lift your left knee and bring your opposite elbow toward it. Flex at the trunk and rotate your upper body toward your leg.

STAGE TWO

Breathe in as you return to the starting position, with control. Repeat, raising the opposite leg and elbow, then repeat an equal number of reps on both sides.



Double-tap image to read the labels

ALTERNATING V-UP CRUNCH

This exercise involves coordinating movements on opposite sides of the body while maintaining a neutral spine and pelvis. For more of a challenge, hold for 1 second at the top position, and keep both legs raised throughout the set.

PREPARATORY STAGE

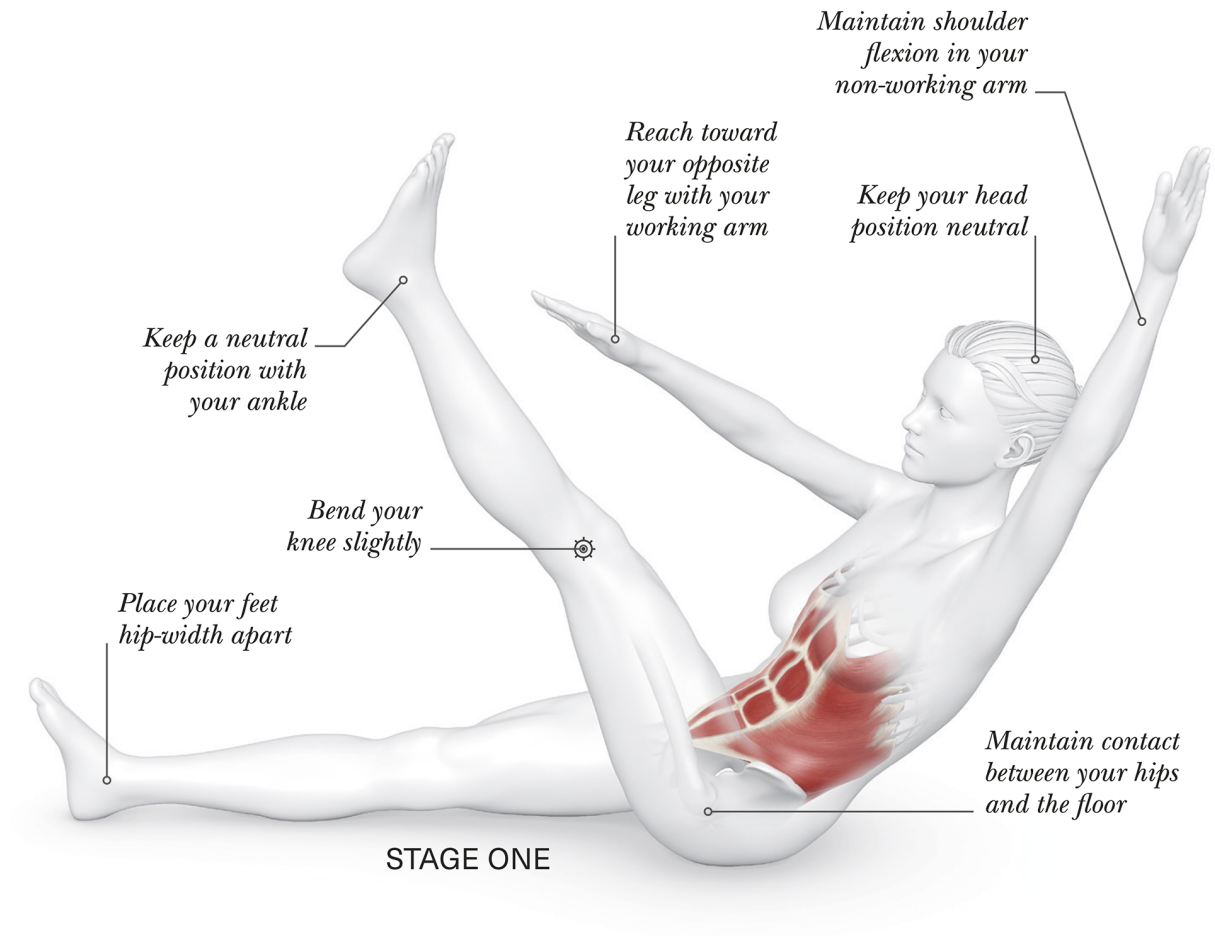
Lie flat on your back with your arms fully flexed at the shoulders, reaching behind you, and your legs straight. Lift your head off the ground slightly.

STAGE ONE

Breathe in to brace your core. Exhale as you lift your left leg up and bring your right arm toward it, then flex at the trunk to rotate your upper body toward your lifted leg.

STAGE TWO

Breathe in to return to the starting position, with control. Repeat, raising the opposite arm and leg, then repeat an equal number of reps on both sides.



Double-tap image to read the labels

◀ CONTENTS

PREVENTING INJURY







Strength training is among the safest of training modalities but is not without risk of injury, so it pays to be aware of the common injuries so that you can guard against them. Correct execution of any exercise is the main way to avoid injury, but readying your body ahead of a workout and letting it recover afterward are also key.

INJURY RISK
DELAYED-ONSET MUSCLE SORENESS
COMMON INJURIES
    IN THE SHOULDER
    IN THE ELBOW
    IN THE LOWER BACK
    IN THE HIP
    IN THE KNEE
RETURNING TO TRAINING AFTER INJURY
DESIGNING A ROUTINE
MOBILITY EXERCISES
COOL-DOWN STRETCHES

INJURY **RISK**

Strength training is a safe, effective way of improving your health, stimulating muscle growth, and improving body composition. That said, it does come with a risk of injury but you can mitigate these risks by exercising regularly, and focussing on the structure of your workout and on the execution of the exercises.

A **CONSISTENT** APPROACH

Following a progressive training programme gives your body time to adapt, get stronger, and build muscle mass. For this to happen, consistency is key. The benefits of strength training come only while you are consistently training. Set aside certain days of the week according to the split of your training programme – how many times you want to train every week. Long durations of time spent away from strength training reverses the good you've done, so sticking with the programme is the route to success and the way to mitigate risk of injury. Track your progress to see your improvements that follow incrementally upward.

PREPARING THE BODY

Many injuries result from diving straight into a strength training session without warming up properly or mobilizing your joints ahead of the workout. Preparing your body is key to avoiding injury. With any programme, it's more than just following the reps and sets and improving your execution of the exercises that are important. It's crucial to structure each and every workout in the same way (see Routine Safety) and

to stick to the routine, even as you make gains, to minimize the risk of injury while exercising regularly.

Routine safety

For optimum safety and for minimizing the risk of injuries in every training session, always tailor your workout routine to follow this structure.



Double-tap image to read the labels

Warm-up

Starting all training sessions with warm-up exercises (consisting of aerobic activities or dynamic stretches) is a must to prepare the body for the upcoming workout.

Mobility exercises

See how your body responds to mobility exercises (and check for any areas of stiffness) once your body is warmed up. Mobilize the relevant parts ahead of the session's work.

Strength training exercises

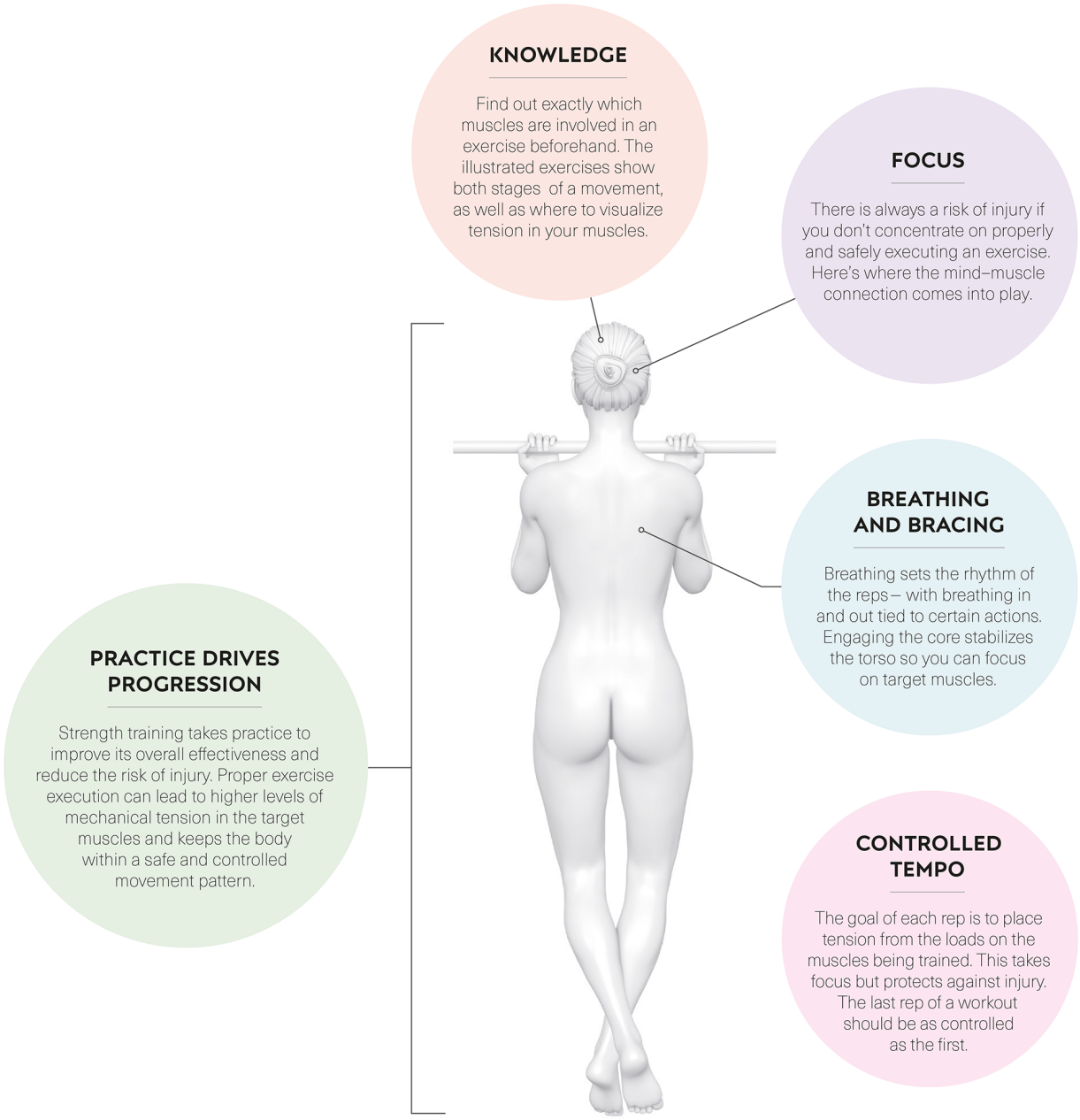
Stick to your training programme, ensuring you focus on the correct execution of the exercise (see image) and keep track of your progress.

Cool-down stretches

Stretch for at least 5–10 minutes. Short-hold (5–30 secs) static stretches improve flexibility and release tension in worked muscles. Plus, they provide an opportunity to wind down after exercise. .

THE IMPORTANCE OF **EXECUTION**

Strength training's risk comes from performing exercises that place your body into unstable positions while under load. These positions will become more stable over time as you build flexibility and overall strength. A good exercise technique involves thought about a proper set-up, understanding what the exercise demands, concentration, proper breathing and bracing, and a controlled repetition tempo. Then, it's a matter of repeating to improve.



i Double-tap image to read the labels

PRACTICE DRIVES PROGRESSION

Strength training takes practice to improve its overall effectiveness and reduce the risk of injury. Proper exercise execution can lead to higher levels of mechanical tension in the target muscles and keeps the body within a safe and controlled movement pattern.

KNOWLEDGE

Find out exactly which muscles are involved in an exercise beforehand. The illustrated exercises (see Strength Exercises) show both stages of a movement, as well as where to visualize tension in your muscles.

FOCUS

There is always a risk of injury if you don't concentrate on properly and safely executing an exercise. Here's where the mind–muscle connection comes into play.

BREATHING AND BRACING

Breathing sets the rhythm of the reps – with breathing in and out tied to certain actions. Engaging the core stabilizes the torso so you can focus on target muscles.

CONTROLLED TEMPO

The goal of each rep is to place tension from the loads on the muscles being trained. This takes focus but protects against injury. The last rep of a workout should be as controlled as the first.

46% OF INJURIES ARE **SPRAINS** (DAMAGE TO A LIGAMENT) AND **STRAINS** (AN OVERSTRETCH OR TEAR IN A TENDON OR MUSCLE).

DELAYED-ONSET **MUSCLE SORENESS**

Delayed-onset muscle soreness – DOMS – is when your muscles start to hurt and feel stiff in the days following a workout; your trained muscles won't generate as much force and your performance will decline during this time. While DOMS brings with it a host of detriments, it is a normal response to working your muscles harder.

IS SORENESS **NORMAL**?

Yes, and the soreness follows when you train at a higher intensity, frequency, duration, and resistance (see Variables within strength training) such as when starting a new training programme. Such workouts lead to mechanical tension, metabolic stress, and muscle damage (see How muscles grow) – all of which challenge your body, forcing it to adapt, build more muscle, and get stronger. Once your body adapts to the level of workout, you won't experience soreness until you introduce more challenge again.

What's a good level of soreness?

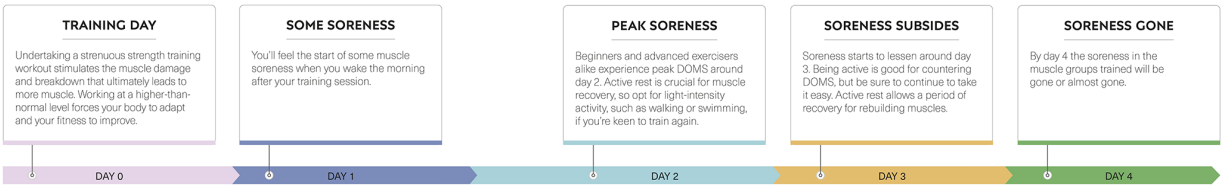
It's useful to register the level of soreness after a workout as it can be a helpful indicator that target muscles were trained, but it's also important to tell when pain and/or restricted motion may indicate an injury. Use the table to help you assess if your soreness is DOMS or an injury.

DOMS VERSUS POTENTIAL INJURY

Muscle is tender to the touch.	Sharp, intense pains in muscle or near a joint.
Muscle fatigue reached much quicker than usual.	Continuous discomfort in daily activities, limiting your ability to perform simple tasks.
Loss of muscle strength or performance.	Loss of range of motion, strength, and performance within muscle or joint.
Discomfort subsides after 24–96 hours and improves as time goes on.	Discomfort persists past 48–96 hours and does not seem to improve.
DOMS A discomfort that limits muscles' range of motion or performance without long-term consequences. As the muscles recover, the discomfort will subside.	INJURY A discomfort or pain that persists and impacts structural abilities to perform exercises or activities of daily life. Seek medical guidance from a physiotherapist.

When DOMS strikes

Knowing what to expect when may help you deal with the muscle soreness after starting a new programme or completing a particularly strenuous session. Time is the only healer for DOMS, so be sure to take the rest days in your training programme.



Double-tap image to read the labels

DAY 0

TRAINING DAY

Undertaking a strenuous strength training workout stimulates the muscle damage and breakdown that ultimately leads to more muscle. Working at a higher-than-normal level forces your body to adapt and your fitness to improve.

DAY 1

SOME SORENESS

You'll feel the start of some muscle soreness when you wake the morning after your training session.

DAY 2

PEAK SORENESS

Beginners and advanced exercisers alike experience peak DOMS around day 2. Active rest is crucial for muscle recovery, so opt for light-intensity activity, such as walking or swimming, if you're keen to train again.

DAY 3

SORENESS SUBSIDES

Soreness starts to lessen around day 3. Being active is good for countering DOMS, but be sure to continue to take it easy. Active rest allows a period of recovery for rebuilding muscles.

DAY 4

SORENESS GONE

By day 4 the soreness in the muscle groups trained will be gone or almost gone.

How best to limit DOMS?

To avoid working out when some muscles are already sore, it's crucial to follow a well-designed, progressive training programme as well as registering how you feel ahead of a workout. Large amounts of muscle damage will work against you and limit your ability to improve over time. So, if you're looking to train several times a week, be sure to divide up your programme so that it works different muscle groups each time (see Training programmes to learn about the splits of training for working out 3x, 4x, or 5x a week).

GOOD ROUTINE OF TRAINING AND REST

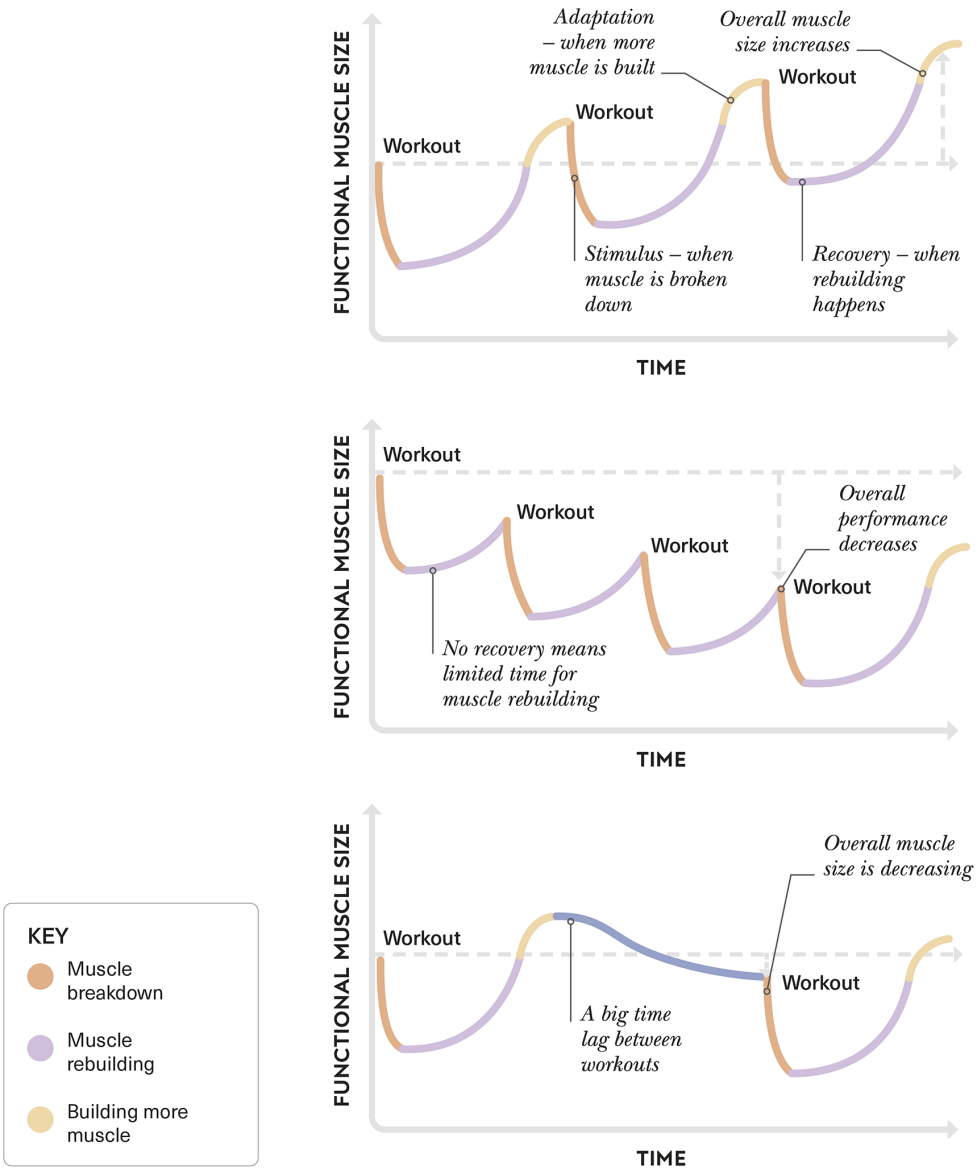
After a workout there's a short period of muscle breakdown, which is followed by recovery and the rebuilding of those damaged muscle fibres. Afterward, a period of adaptation allows muscles to build new fibres as a response to being worked hard. This cycle builds muscle overall.

TRAINING TOO OFTEN

If recovery time is restricted or excluded altogether from training, the body has no opportunity to rebuild the damaged muscle let alone adapt to build new muscle fibres. Such a cycle leads to diminishing overall muscle size and performance, despite the extra muscular work done.

TRAINING TOO INFREQUENTLY

If there are not enough training sessions across a certain time, the adaptation advantage is lost. Such a training cycle will not build muscle and overall muscle size and training performance declines.



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COMMON INJURIES

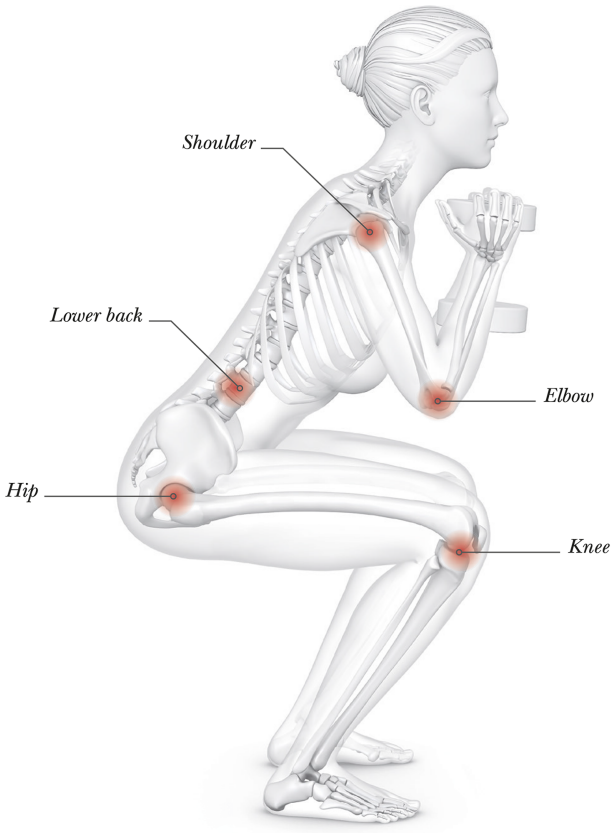
An injury during a strength training workout – whether a muscular or an overuse injury – can happen to anyone, regardless of experience or fitness level. You can limit your risk of injury by learning how to spot the signs and symptoms of common injuries as well as picking up tips on prevention and recovery after injury.

SELF-HELP MEASURES

Despite the relative safety of strength training, there is a risk of injury. If you do suffer from an injury, the word "POLICE" makes for a useful reminder of what to do: **P**rotection (protect the area injured); **O**ptimal **L**oading (do not overwork but keep moving); **I**ce (apply ice to relieve pain); **C**ompress (use a compression bandage); **E**levation (raise the injured site to reduce swelling).

COMMONLY INJURED AREAS

The main sites of injury during strength training are the shoulder, the knee, and the lower back; additional sites include the elbow and the hip.



ℹ Double-tap image to read the labels

INJURY **TYPES**

The two most common types of injuries of strength training are overuse injuries and muscle strains. Injuries can be caused by: not properly warming up the body; overstretching a muscle beyond its range of motion; or demanding more than a muscle is capable of (overexertion).

Overuse injuries

Tendinitis is the inflammation of the tendon and the micro-tears resulting from overloading of the muscle–tendon unit with too much load or too sudden a movement. Tendinosis is the degeneration of the tendon in response to chronic overuse without proper time to heal.

Muscular injuries

A tension-based force exerted on a muscle can lead to excessive stretching of the muscle fibres and can potentially lead to a tear close to the myotendinous junction (see Muscular Anatomy).

IN THE **SHOULDER**

The shoulder is a complex ball-and-socket joint of muscles and supporting structures to create an integrated system of movement. Since the shoulders are involved with most actions performed at the gym, they are a common site of injury.

CAUSES AND SYMPTOMS

The shoulder's glenohumeral joint favours mobility at the expense of stability, relying on supporting structures, such as the rotator cuff. Repetitive use, explosive moves, and poor technique are common causes of injury.

Tears – micro-tears to tendons or muscles or bigger tears in the muscle–tendon unit.

Tendinitis – acute inflammation at the joint.

Tendinosis – degeneration of the tendon from chronic overuse.

Impingement – pinching of the tendons within the rotator cuff.

Symptoms include:

pain at and around the joint

inflammation.

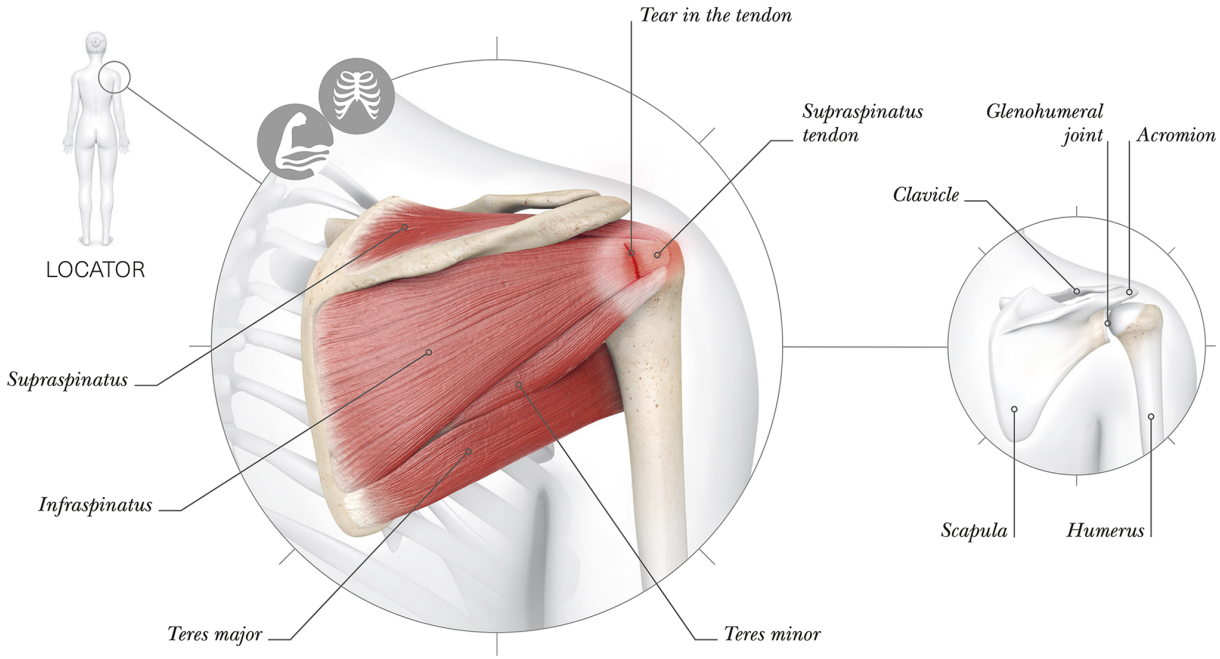
PREVENTION

Proper organization of your training sessions as well as attention to correct exercise technique can help prevent injury to the rotator cuff. A high rate of injury is from overuse, so limit your training frequency and ensure adequate rest to allow muscles and tendons to fully heal.

RETURNING TO TRAINING

After an injury, be sure to increase training volume and frequency appropriately over the first 4–8 weeks. Too much too

soon can set you back. Utilize mobility exercises that strengthen the shoulder and rotator cuff.



Double-tap image to read the labels

POSTERIOR VIEW

IN THE ELBOW

The elbow is a hinge joint (similar to a door hinge) where there is movement happening in only one plane. The elbow is a common site of injury, since it helps most movements performed by the upper body.

CAUSES AND SYMPTOMS

The most common injury experienced in strength training at the elbow is "tennis elbow" (aka lateral epicondyle tendinopathy). Common causes include:

- repetitive use or underuse of the extensor muscles of the forearm
- poor exercise technique
- repetitive use of barbells (can place large stress on the elbow)

Symptoms include:

- pain at the lateral epicondyle (the bony bit of the elbow)
- pain during loaded or resistive exercises involving the wrist or elbow joint.

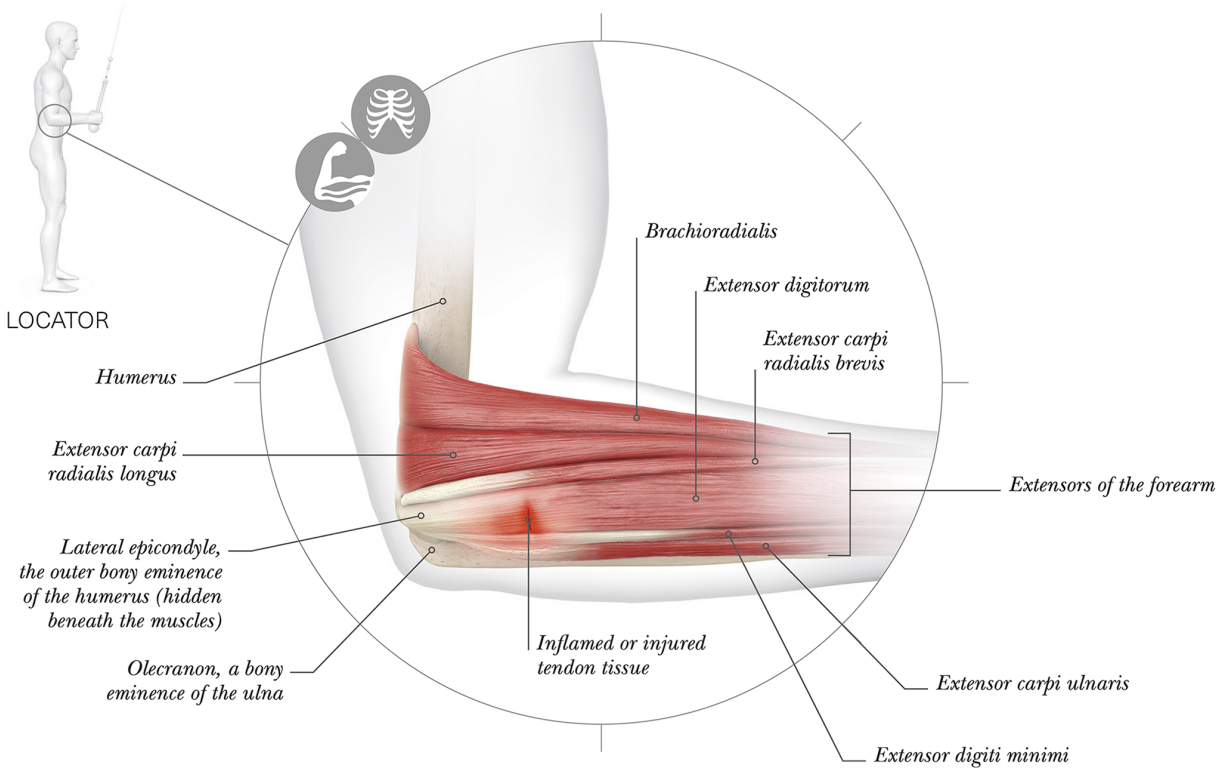
PREVENTION

Appropriate exercise selection and proper execution of exercises involving the elbow, alongside strengthening extensor forearm muscles, reduces the likelihood of injury. A high rate of injury is from overuse, so limit your training frequency (how many times you're training on this joint) and ensure adequate rest to allow muscles and tendons to fully heal.

RETURNING TO TRAINING

Be sure to increase training volume and frequency appropriately over the first 4–8 weeks. Too much too soon can set you back. Utilize mobility exercises that help add strength and stability to

the extensor muscles of the forearm and elbow. Stretches of extensor muscles can also improve recovery time.



Double-tap image to read the labels

LATERAL VIEW

IN THE **LOWER BACK**

Injuries of the lower back may be one of the most common strength training injuries, alongside the shoulder, due to the complexity of the hip and trunk muscles involved in generating and stabilizing movement of the lower body.

CAUSES AND SYMPTOMS

Lower-back muscle strain – one of the most common lower-back injuries – is most often due to a lack of pelvic control or lack of coordination with the abdominal muscles. Other causes include:

- repetitive use
- misalignment of the spine during an exercise
- excessive loading without proper support or control.

Symptoms include:

- sharp pain
- stiffness
- inflammation
- overall discomfort of the joint.

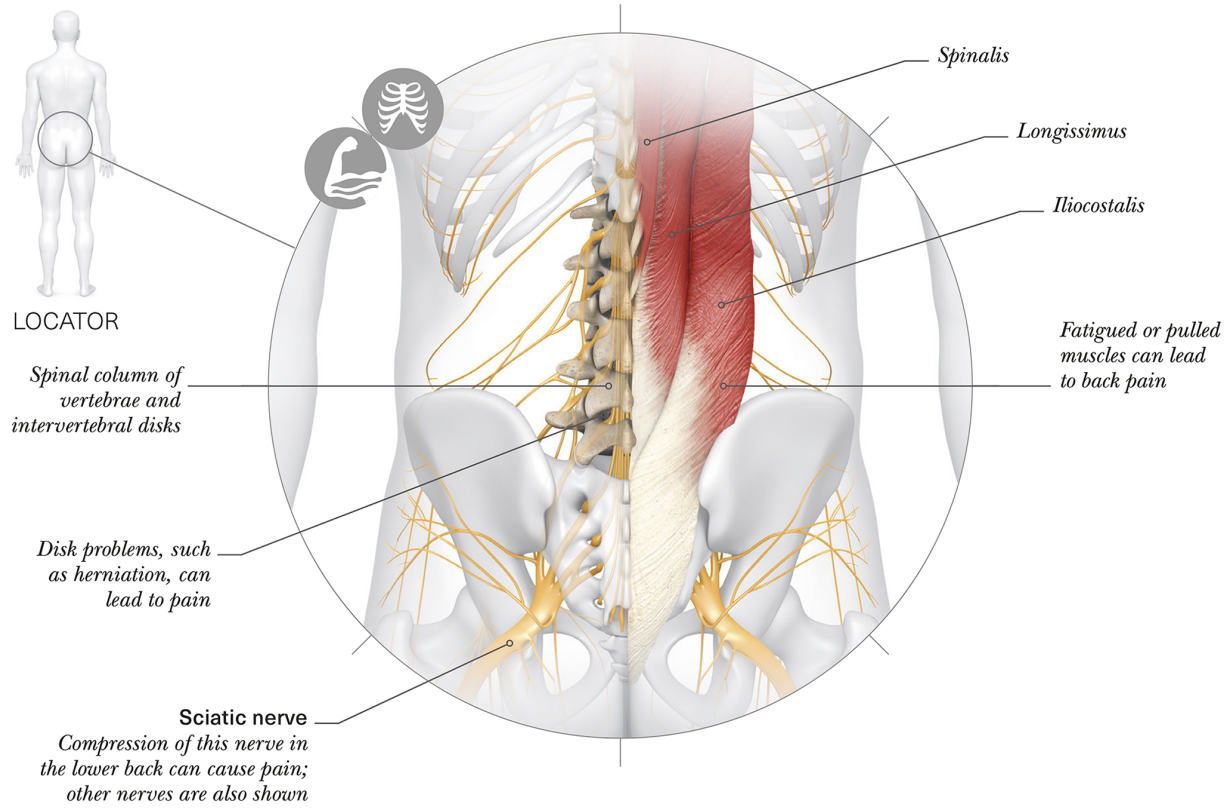
PREVENTION

Proper exercise technique can help prevent lower-back muscle strain alongside building strength in your abdominals and core. It's a good idea to avoid excessive stresses or repetitive usage of movements that aggravate or worsen pain in your back.

RETURNING TO TRAINING

After an injury, be sure to increase training volume and frequency appropriately over the first 4–8 weeks. Too much too soon can set you back. Utilize mobility exercises that will add

strength and stability to the muscles of the lower back. Such exercises can offer relief alongside adjustments to your training to lessen the strain on this area.



Double-tap image to read the labels

POSTERIOR VIEW

Sciatic nerve

Compression of this nerve in the lower back can cause pain; other nerves are also shown

IN THE **HIP**

Because the hip has a large range of motion in many planes and involves a complex system of supporting structures and muscles (attaching to the hip, knee, and torso), it can be injured from a variety of different actions.

CAUSES AND SYMPTOMS

One of the most common injuries experienced in strength training is gluteal tendinopathy (aka greater trochanteric pain syndrome or "rotator cuff syndrome of the hip"). Common causes include:

- repetitive stress to the gluteal tendinous attachments of the gluteus medius and gluteus minimus muscles
- bursitis of the hip – bursitis is the inflammation of small, fluid-filled sacs that cushion muscles, bones, and tendons near joints.

Symptoms include:

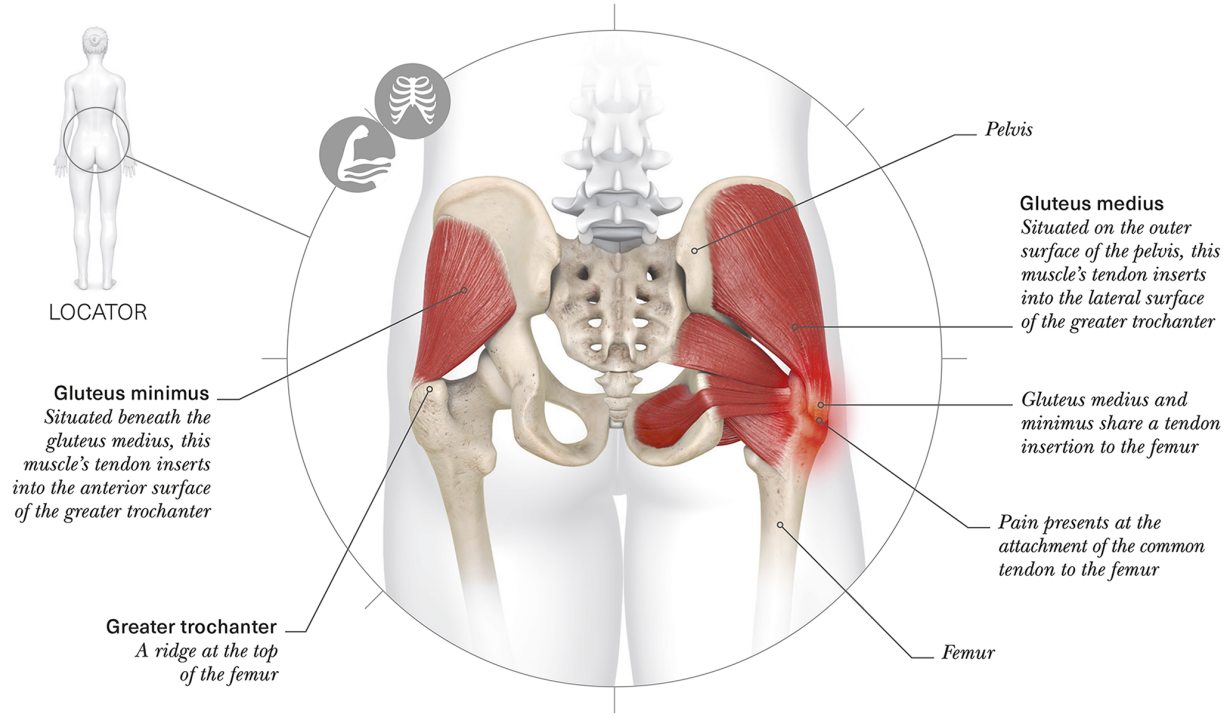
- pain at the site
- discomfort when walking, trying to train, or even sitting or lying on the affected hip.

PREVENTION

Appropriate exercise selection and proper execution of exercises can help prevent gluteal tendinopathy. Avoiding excessive stress or repetitive use of movements such as hip abductions or "band walks" (with resistance bands around the legs). Overuse of mobility exercises can overload this area and lead to higher risk of aggravation and injury.

RETURNING TO TRAINING

Be sure to increase training volume and frequency appropriately over the first 4–8 weeks. Too much too soon can set you back. Utilize mobility exercises that help add strength and stability to the glutes and muscles of the hip.



ⓘ Double-tap image to read the labels

POSTERIOR VIEW

Gluteus minimus

Situated beneath the gluteus medius, this muscle's tendon inserts into the anterior surface of the greater trochanter

Gluteus medius

Situated on the outer surface of the pelvis, this muscle's tendon inserts into the lateral surface of the greater trochanter

Greater trochanter

A ridge at the top of the femur

IN THE **KNEE**

The knee is a common site of injury as many strength training exercises load knee flexion and extension, such as back squats, lunges, and leg extension.

CAUSES AND SYMPTOMS

Pain around, behind or below the patella (knee cap) is commonly known as “runner’s knee” or, strictly, patellofemoral syndrome. It’s the most common cause of anterior knee pain in exercisers. Common causes include:

- overuse (the most common)
- malalignment of the lower extremity and/or patella
- muscular imbalances of the lower extremity
- improper loading.

Symptoms include:

- pain around, behind, or below the anterior part of knee
- pain that is exaggerated by loaded knee flexion exercises.

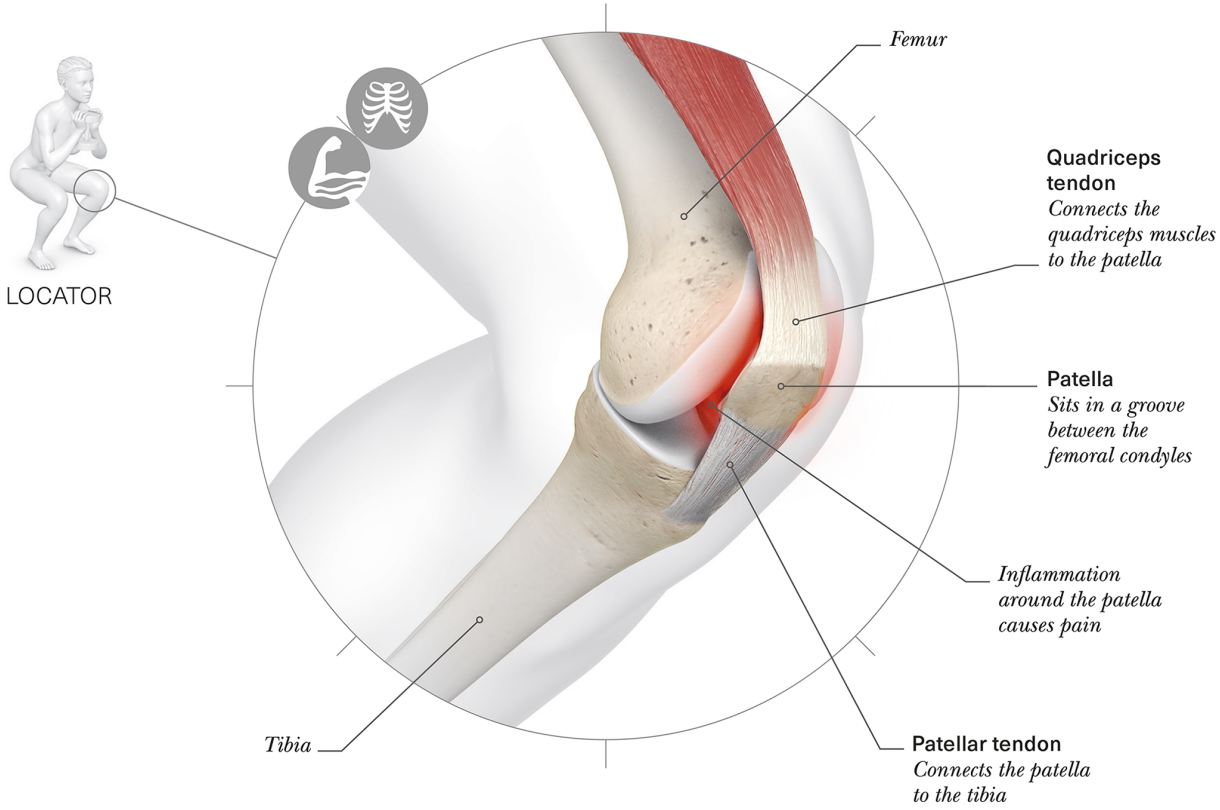
PREVENTION

Proper execution technique can help to prevent this condition alongside building up strength in your quadriceps, hamstrings, and muscles of the calves – all of which play a role in stabilization of the knee. Misalignment or poor tracking of the knee can exaggerate symptoms, so you’ll need to rule this out as a direct cause. Do avoid excessive stress or repeated movements that aggravate or worsen the condition.

RETURNING TO TRAINING

Be sure to increase training volume and frequency appropriately over the first 4–8 weeks. Utilize appropriate repetition tempo and

exercises (limit those that stress the knee) to help alleviate any unnecessary stress on the joint.



Double-tap image to read the labels

ANTERIOR-MEDIAL VIEW

Quadriceps tendon

Connects the quadriceps muscles to the patella

Patella

Sits in a groove between the femoral condyles

Patellar tendon

Connects the patella to the tibia

RETURNING TO TRAINING AFTER INJURY

The return to regular exercise after an injury can be tough. You'll probably feel motivated to get back to full performance, but may be limited by your ability to perform at first, which can bring frustration. Choose from the various strategies available to find those that work for you.

RECOVERY STRATEGIES

The ability to restore range of motion, function, and overall strength and performance will depend on your ability to remain patient, strategic, and listen to your body during the recovery process. One of the most common ways of re-injuring yourself or worsening a condition is doing too much too soon.

When returning to strength training, there are several strategies at your disposal to ensure you are able to start training and to rebuild your strength and performance safely.

MODIFY YOUR PROGRAMME

You can make tweaks to your training programme, such as by reducing training volume and training intensity on the affected or injured area. Ensure you adjust the potential variables – the training load, the amount of training volume, and the frequency of training the affected area – and are not making the condition or discomfort worse by overloading or overuse. If avoiding volume and intensity on a specific muscle group or joint, you can continue to train as normal with other muscles and joints. For

example, if dealing with a biceps injury, you could continue with lower-body strength training as long as it does not directly affect your recovery.

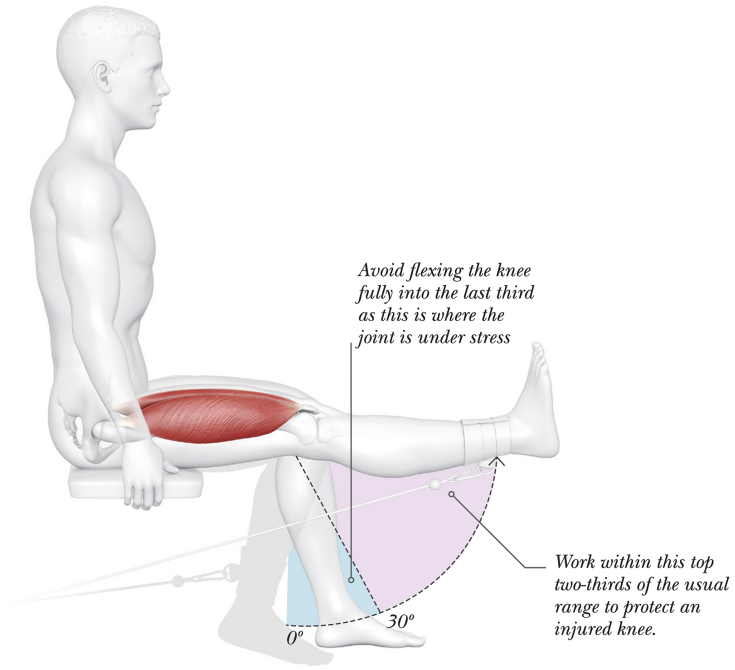
ADJUST YOUR POSITION

Implement variations of an exercise or positional adjustments to be able to work around any discomfort. Use cables or machines whenever possible to ensure that your training environment is safe and your range of motion is limited. Altering the range of motion in a given exercise can help train a specific area while also working around an injury or any discomfort.

For example, if you still experience pain or discomfort in the knee through a full range of motion when performing a leg extension (see Altering range of motion), you can adjust the range of motion to train in a range where there is no discomfort, such as the upper two-thirds of a leg extension.

ALTERING RANGE OF MOTION

The leg extension offers possibilities to work with cables for a safe training environment and to tweak the working range of motion while still training muscles adequately.



Double-tap image to read the labels

LATERAL VIEW

TWEAK THE TEMPO

Altering the repetition tempo (the time spent in the eccentric and concentric phases of a movement; see Guidance on tempo) can allow you to work around an injured muscle or any tendon-related discomfort.

Expanding on the leg extension exercise above, if you cannot heavily load the exercise due to joint discomfort, you can alter your repetition tempo to increase the amount of time the quads are under tension and still enable adequate stimulus. For example, you could insert a pause at the top of the exercise – while continuously maintaining tension on and contracting the quads – for 2–4 seconds. Likewise with the eccentric, you could up the time under tension by extending the time in the lowering portion.

FOCUS ON THE LOCAL

Choose an exercise that localizes a given muscle group or joint. If you have knee pain, for instance, you could continue to train the quads by performing leg extensions instead of barbell back squats and adjust the rep tempo.

Don’t rush recovery

There is a psychological component to returning from an injury. Depending on the severity of the injury, it is worth building confidence in performing an exercise before returning to your previous training loads or performance levels. Do not rush your recovery – “no pain, no gain” does not apply to this process. If you are in any discomfort, utilize training adaptations, medication, or seek qualified medical guidance to properly address the situation.

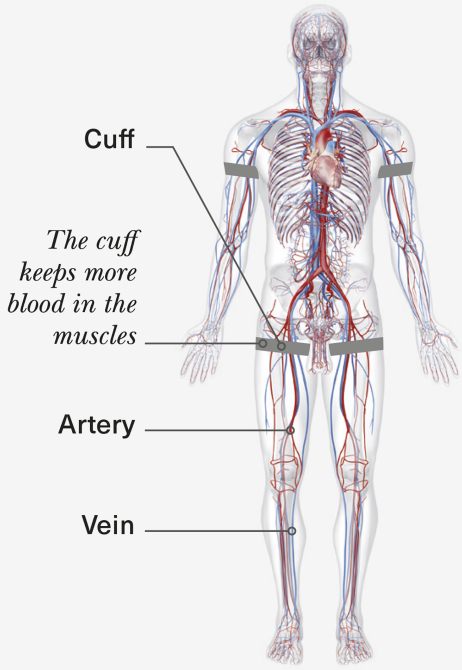
Blood flow restriction training

KAATSU training – a patented training style developed in Japan in the 1970s by Dr Yoshiaki Sato – uses engineered cuffs to shut off blood flow to a specific limb. Blood flow restriction (BFR) training is a variation of this method and has been shown to be an effective way to work around an injury and keep training. BFR training involves the application of a cuff on the training limb nearest its point of attachment to the body while exercising (see the cuff positions). The application of the cuff partially restricts arterial blood flow (blood coming into the muscle) and significantly or completely restricts venous return (blood flowing out of the working muscle).

This method of training has shown to:

- help work around injuries
- help the rehabilitation process
- minimize pain while doing exercises
- act as a way to train more effectively with lower loads – as low as 20–30 per cent of 1RM.

Compared with high-load strength training where 70–85 per cent of 1RM is often recommended (you can work at lower levels), with BFR training you can continue to work out effectively using lower loads. It can also boost muscle growth (hypertrophy), combat muscle loss (atrophy), and improve muscle strength and function.



Double-tap image to read the labels

PLACES OF APPLICATION

*"Utilizing **several strategies** can **cut recovery time** and help you **regain your previous performance** levels."*

DESIGNING A ROUTINE

Exercising effectively but safely is key to avoiding injury. Following a routine of warming up and mobilizing your body before a strength training session sets you up for a great workout. Finishing off with a cool-down session allows your body to recover and your mind to transition back to everyday life.

AN ACTIVE WARM-UP

A well-designed warm-up helps reduce the risk of injury and readies you for a training session, without tiring you out.

A WARM-UP ALSO AIMS TO:

increase **heart rate**and **blood flow**

raise **body temperature**

activate the **nervous system**

prepare you for **physical work**

ready your mind for the **mental challenges** of focussing on exercise technique, skill acquisition, and overall coordination.

MODES OF STRETCHING

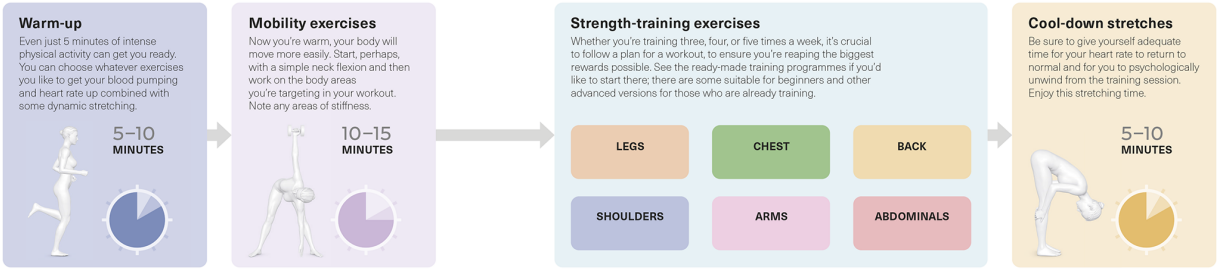
Static stretching, where a pose is held for a time, is not an integral part of a warm-up; only short-duration stretches (<45s) don't impact strength and performance.

Dynamic stretching, where you actively move a limb from its neutral position to its end range of motion within the movement's normal plane of motion, is the most recommended type of stretching before strength training. The goal is to perform

a series of smooth, controlled, and rhythmic moves for a given time or repetitions.

ELEMENTS OF A STRENGTH-TRAINING ROUTINE

Get into good workout habits from the start – following a structured approach to each and every workout will protect you against injury. Waking your body up and preparing it for the workout ahead is key, as is tuning in to how your body is moving during a series of mobility exercises. The length of your strength training routine will vary by the session and what your muscle priorities are that day, but always be sure to finish with a cool down, be that passive, active, or a combination of the two.

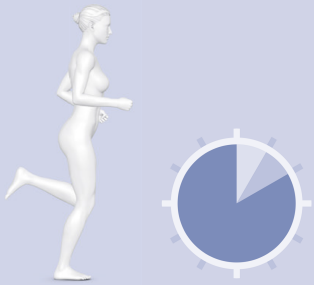


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Warm-up

Even just 5 minutes of intense physical activity can get you ready. You can choose whatever exercises you like to get your blood pumping and heart rate up combined with some dynamic stretching.

5–10
MINUTES



Mobility exercises

Now you're warm, your body will move more easily. Start, perhaps, with a simple neck flexion and then work on the body areas you're targeting in your workout. Note any areas of stiffness.

10–15

MINUTES



Strength training exercises

Whether you're training three, four, or five times a week, it's crucial to follow a plan for a workout, to ensure you're reaping the biggest rewards possible. See the ready-made training programmes if you'd like to start there; there are some suitable for beginners and other advanced versions for those who are already training.

LEGS

CHEST

BACK

SHOULDERS

ARMS

ABDOMINALS

Cool-down stretches

Be sure to give yourself adequate time for your heart rate to return to normal and for you to psychologically unwind from the training session. Enjoy this stretching time.

5–10
MINUTES



5–30 SECS STATIC STRETCHES COULD HELP TO REDUCE MYOTENDINOUS-RELATED INJURIES

MOBILITY WORK

Mobility represents our body's ability to move through a particular range of motion actively before being restricted.

CHOOSING THE EXERCISES

Mobility work is a great addition to any warm-up; it allows you to see how your body moves and feels on any given day. Day to day, depending on previous workouts or stressors, your body can change in its ability to work through a given range of motion without restriction.

Mobility work is specific to getting your body ready for that day's demands. For example, if you are training your upper body, it is a good idea to perform mobility exercises that prepare your shoulders and upper body for the challenges of that day's workout. Same goes for the lower body on a lower body focussed day.

THE **COOL DOWN**

There are two types of common cool-down approaches; choose what works for you and limit it to less than 30 minutes. A passive cool down may involve sitting rest, saunas, foam rolling, static stretching, massage, or controlled and slow rhythmic breathing. An active version comprises a series of low-intensity activities, such as swimming and walking.

A COOL DOWN AIMS TO:

remove **accumulated** lactate from blood and muscle
help prevent the depression of **immune cell numbers**
speed recovery of respiratory and cardiovascular systems
reduce the **risk of injury**
improve **psychological mood**
help you **unwind** from the intensity of your workout.

Foam rolling

You can do foam rolling before or after a workout. While bearing your weight, roll slowly on the roller until you find a tender area, focus on that spot by rolling back and forth until you feel it soften or release. Such self-massage (or administered myofascial release) could produce short-term improvements in flexibility without decreasing muscular performance when done before a training session. Post-workout foam rolling could improve recovery by alleviating the perception of muscle pain. The physiological mechanisms are still unknown. However, there is thought to be a large placebo effect to its positive impacts, which is significant enough to give it merit.

MOBILITY EXERCISES

As we've seen on mobility work, mobility work allows you to see how your body moves and feels on any given day. The range of exercises given here start at the neck and work their way down the body through shoulders, hips, and legs, but you can perform them in any order you like.

NECK FLEXION / EXTENSION

Since much of our waking days are spent looking down at screens, it is important to take the neck through a guided range of motion to ensure muscles of the neck and upper back are ready for the exertion ahead.

PREPARATORY STAGE

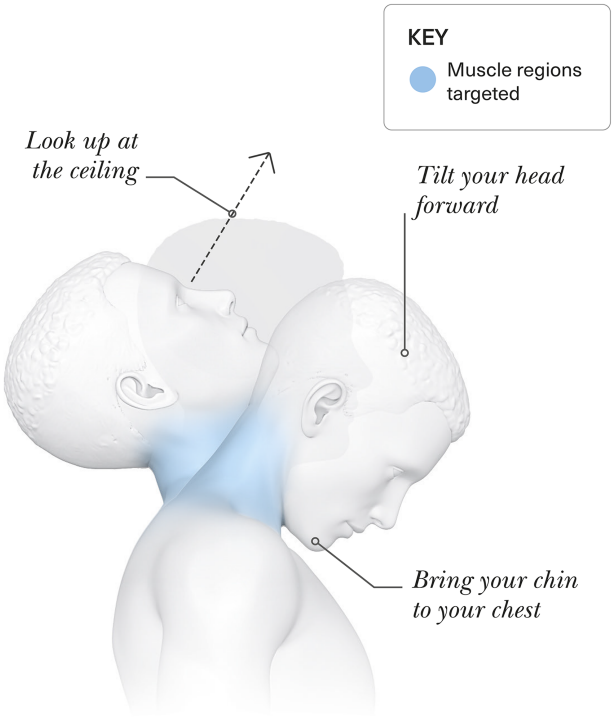
Stand in a neutral position with your feet shoulder-width apart and your core muscles engaged.

STAGE ONE

Flex your neck to stretch the muscles of your upper back and the back of your neck – bring your chin toward your chest. Return your head to neutral.

STAGE TWO

Extend your head back to stretch muscles of the front of the neck – look up at the ceiling; do not force beyond comfort. Return your head to neutral. Perform 5–10 reps.



Double-tap image to read the labels

NECK **ROTATION**

Modern life limits our time spent naturally rotating our head throughout the day – with computer screens and phones the culprits. This exercise ensures the muscles of the neck and upper back are prepared for a workout.

PREPARATORY STAGE

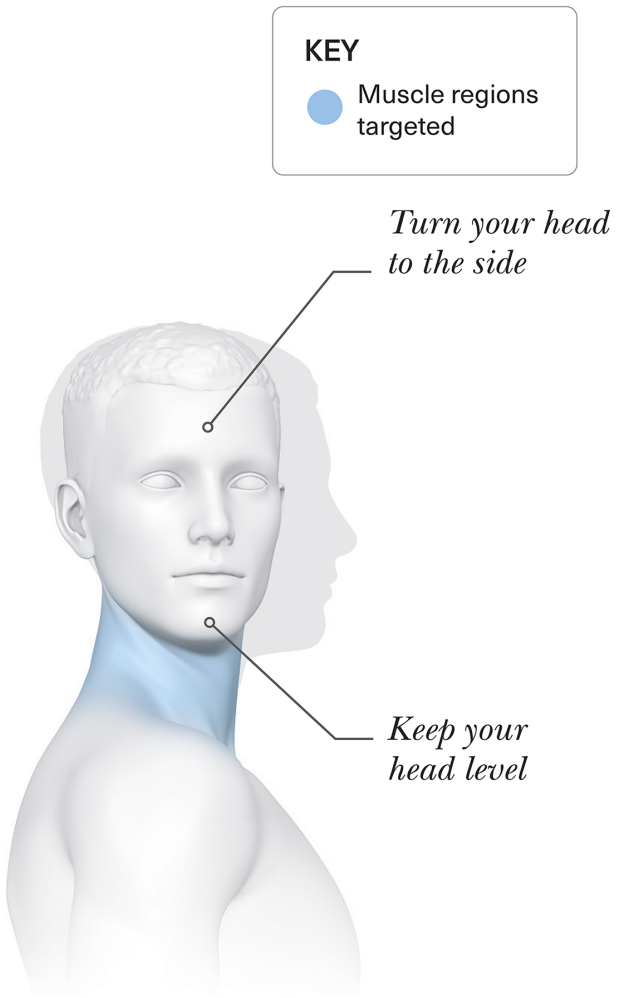
Stand in a neutral position with your feet shoulder-width apart and your core muscles engaged.

STAGE ONE

Rotate your head to the right, feeling a light stretch in the muscles of your neck to help work out any tightness or stiffness before training.

STAGE TWO

Return to neutral (facing front) and rotate your head to the left, feeling a light stretch in the muscles of your neck. Perform 5–10 reps on both sides.



Double-tap image to read the labels

NECK SIDE FLEXION

Another neck exercise completes the range of motion of the head on its axis. This easy exercise helps you avoid hurting neck and upper back muscles when you start to train (which can be common).

PREPARATORY STAGE

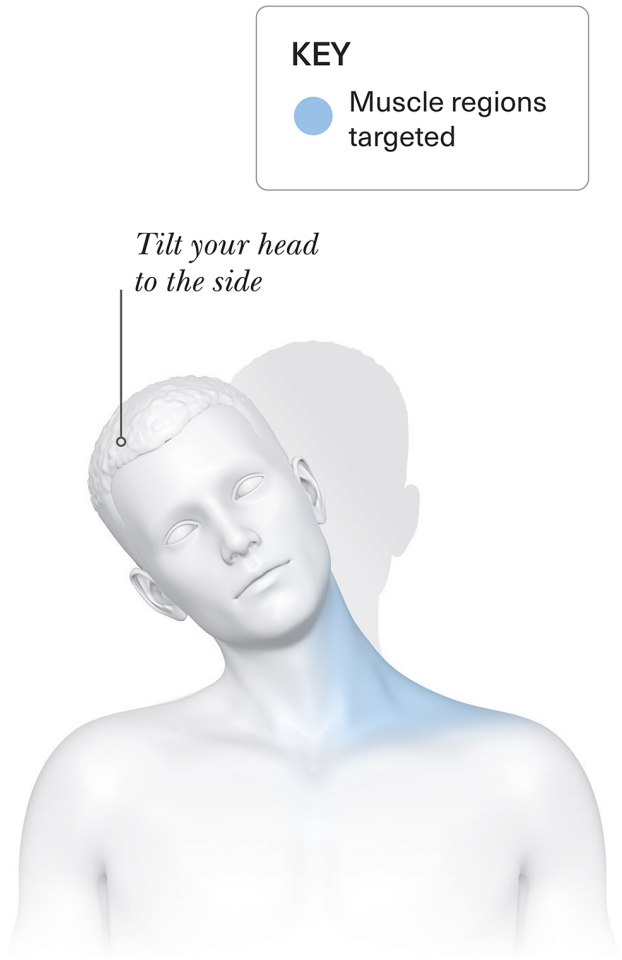
Stand in a neutral position with your feet shoulder-width apart and your core muscles engaged.

STAGE ONE

Flex your neck to one side, feeling a stretch in the muscles of the upper trap and neck – as if trying to put your ear on your shoulder, as far as is comfortable to do so.

STAGE TWO

Return to neutral and then flex your neck to the other side. Perform 5–10 reps on both sides.



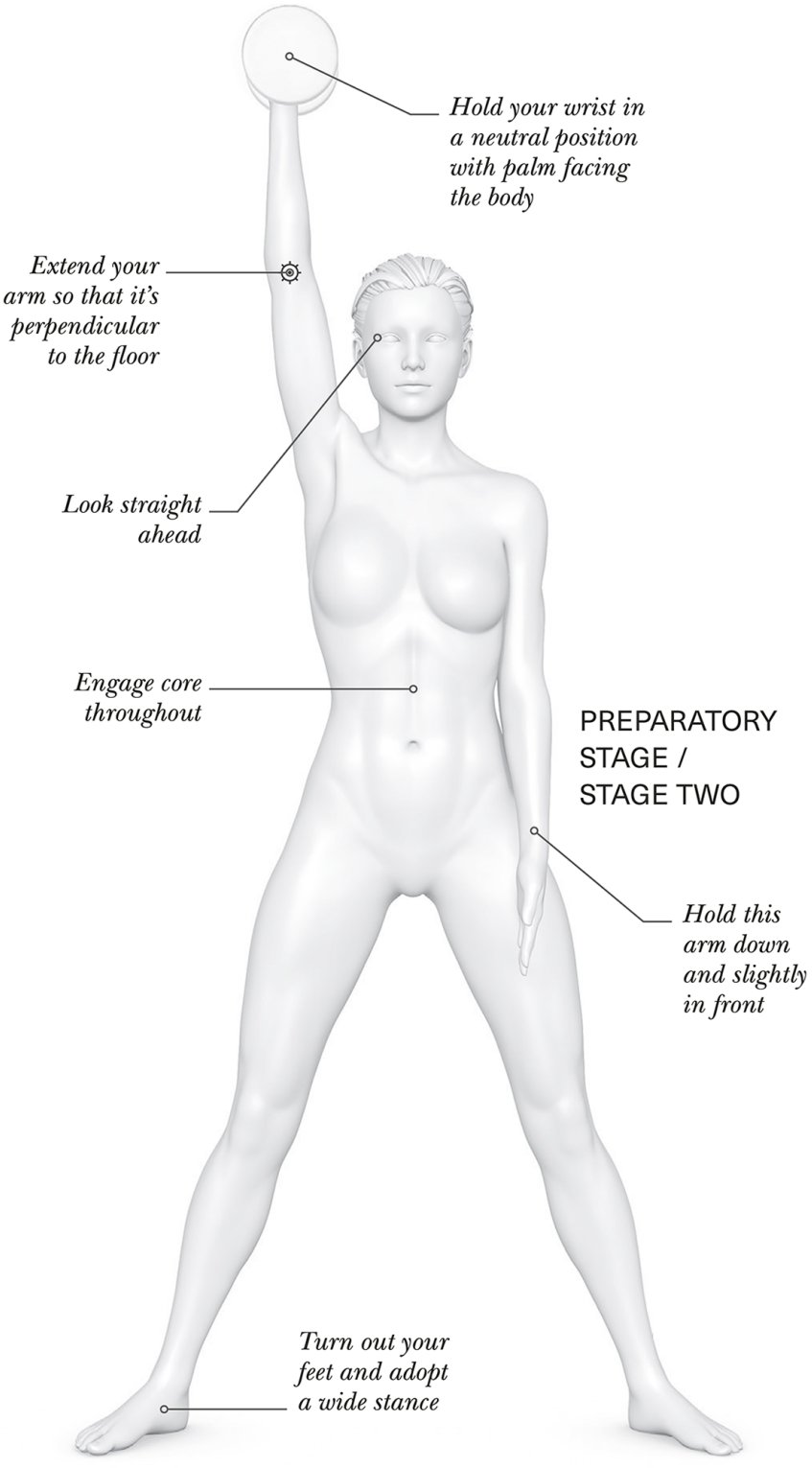
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DUMBBELL WINDMILLS

This exercise works on the mobility and stability of the shoulder, plus it's great for challenging thoracic extension and rotational mobility. Such shoulder mobility work helps prepare your upper body for the resistance it will be challenged with during a training session.

PREPARATORY STAGE

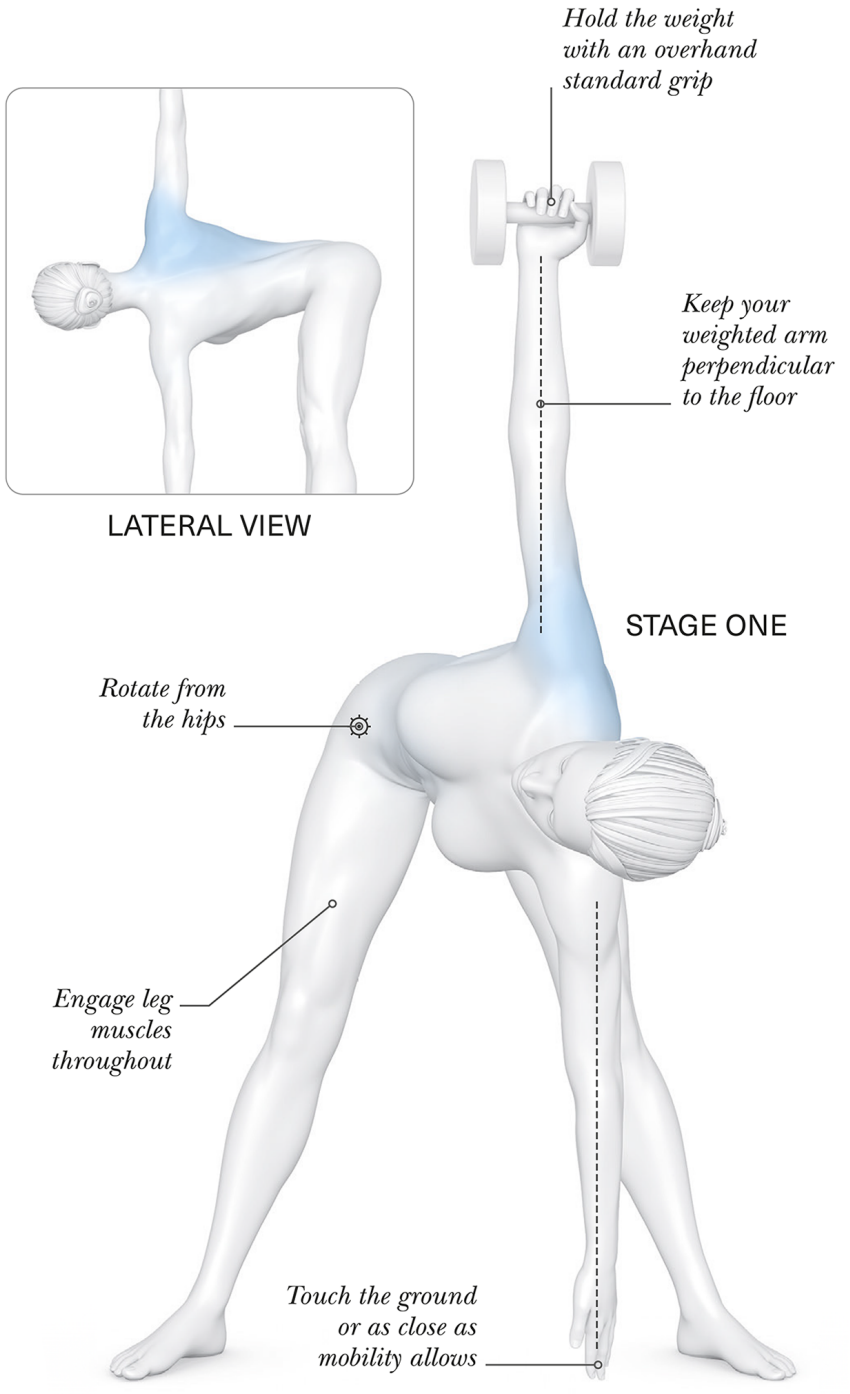
Grab the dumbbell (or kettlebell) and raise it to shoulder height. Then, raise the weight straight up above your shoulder, with your other arm straight in front.



ℹ Double-tap image to read the labels

STAGE ONE

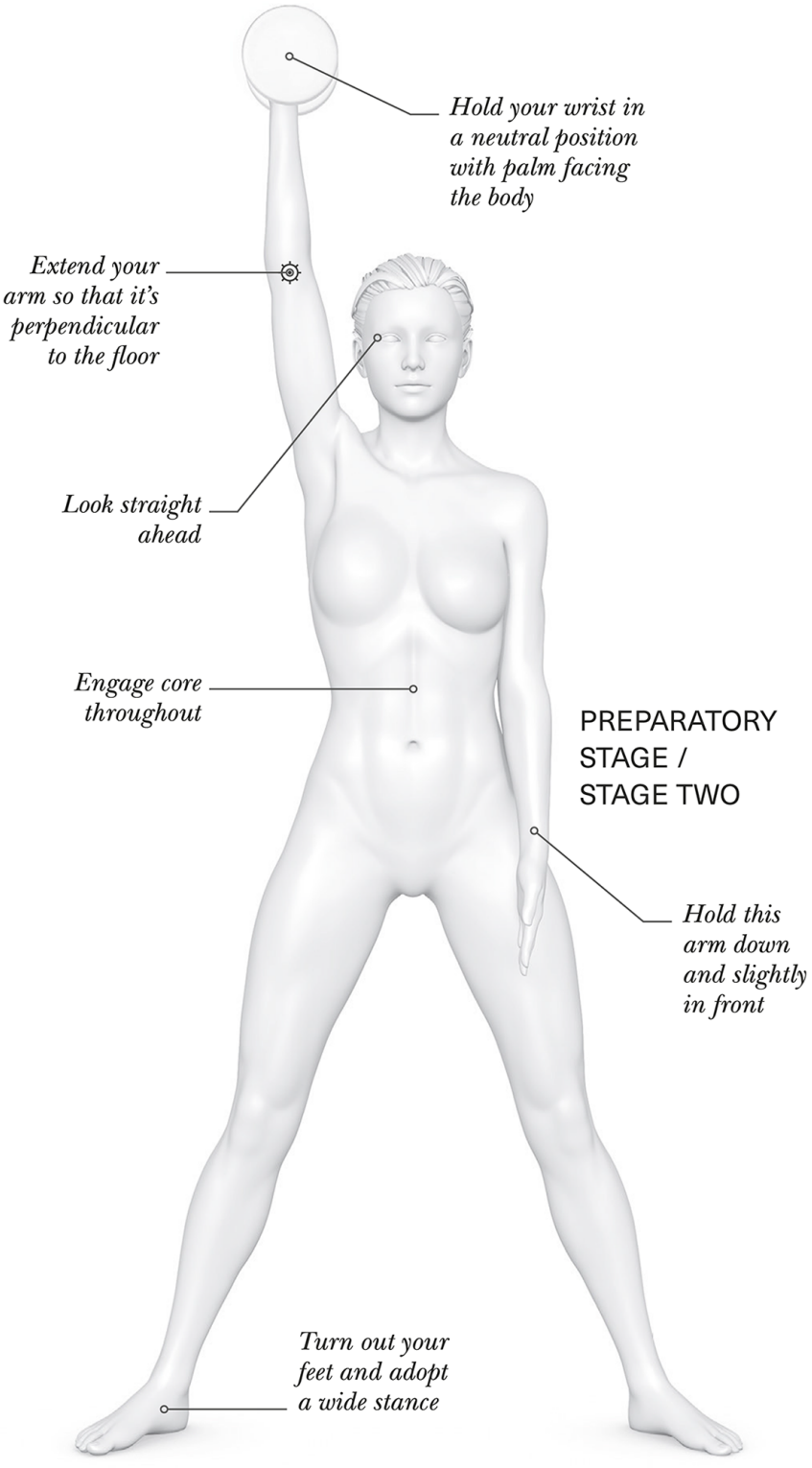
Turn the palm of the hand holding the weight so it faces forward while simultaneously rotating your body and touching the ground with your free hand.



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STAGE TWO

Rotate back to the starting position – with working arm held upright – and repeat stages 1 and 2 for 5–10 reps. Then repeat on the other side.



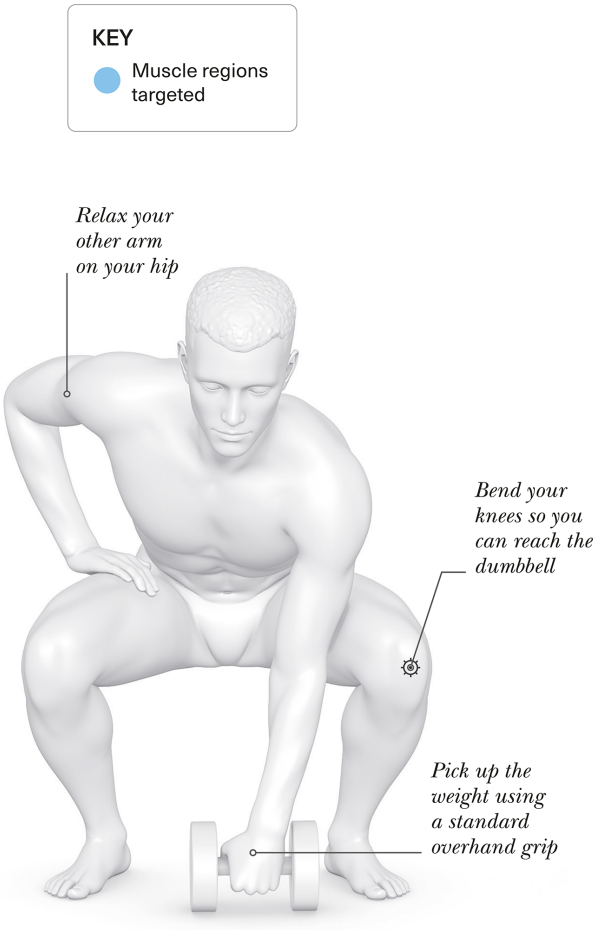
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DUMBBELL BOTTOMS-UP PRESS

This drill challenges the rotator cuff's role in stabilizing external resistive forces at the shoulder. Improving your overhead mobility and the amount of load you can push up from below (in a bottoms-up press) will help stabilize and strengthen muscles of the rotator cuff, and also help to improve your shoulder's ability to stabilize heavy loads overhead. For the maximum challenge in this exercise, switch to a kettlebell, as the resistive forces differ from that of a dumbbell.

PREPARATORY STAGE

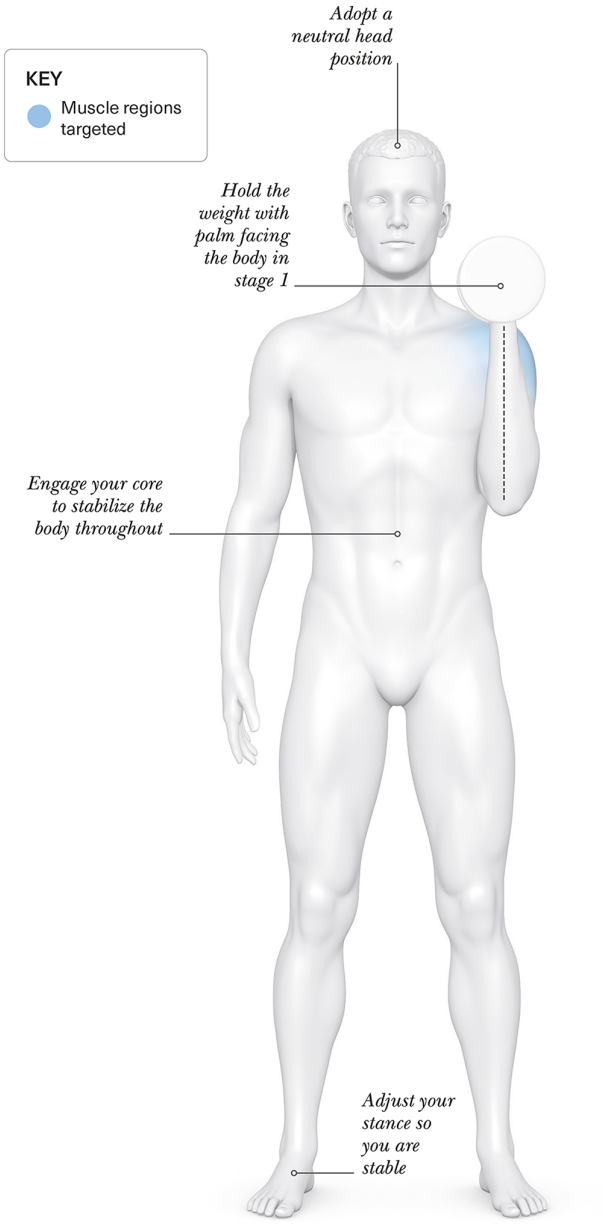
With the weight on the floor in front of you, adopt a hip-width or wider stance. Reach down and pick up the weight with one hand – you can adjust your stance once you are in the stage 1 position.



Double-tap image to read the labels

STAGE ONE

Drive up through the legs to help you raise the weight to shoulder height. Align the dumbbell with your wrist; hold your forearm perpendicular to the floor.

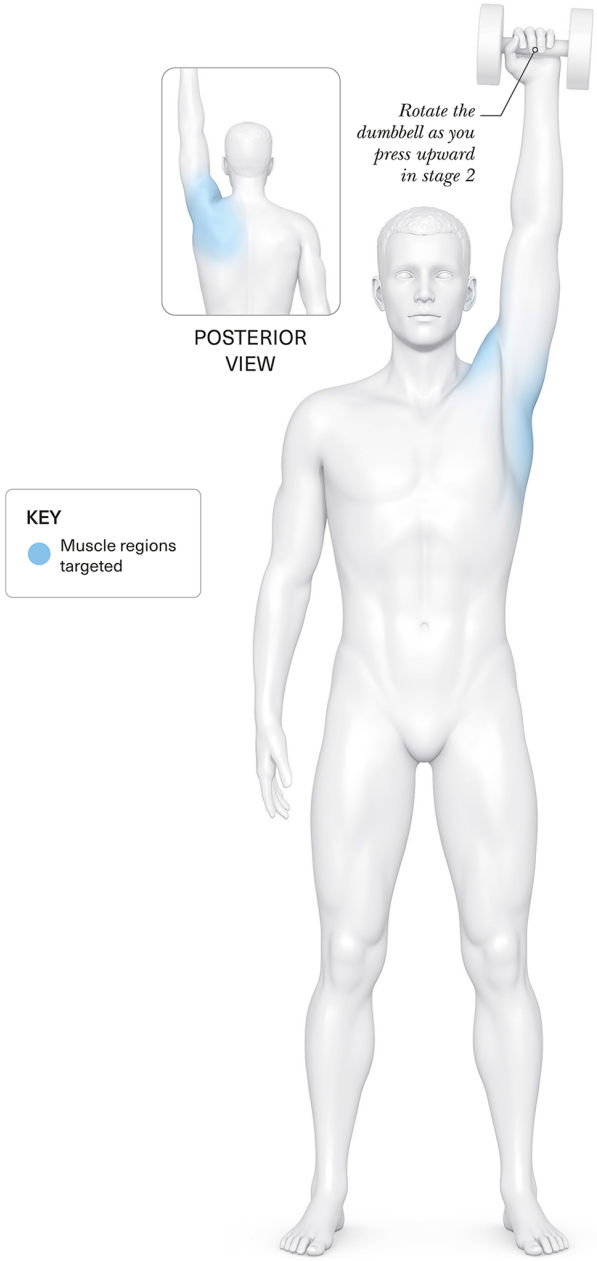


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STAGE TWO

As you press the weight up, rotate your wrist so that your palm faces forward. Return to stage 1 then repeat stages 1 and 2 for 5–10 reps.

Repeat with the other arm.



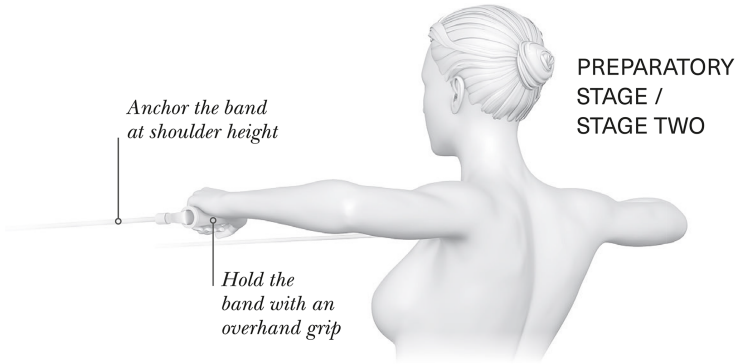
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BANDED EXTERNAL ROTATION

Tasked with the role of stabilizing the shoulder, the rotator cuff is an important group of muscles in terms of maximizing mobility and stability. External rotation is a common deficit many people struggle with in their overhead pressing work. This drill helps challenge stability and strength within the external rotators of the shoulder.

PREPARATORY STAGE

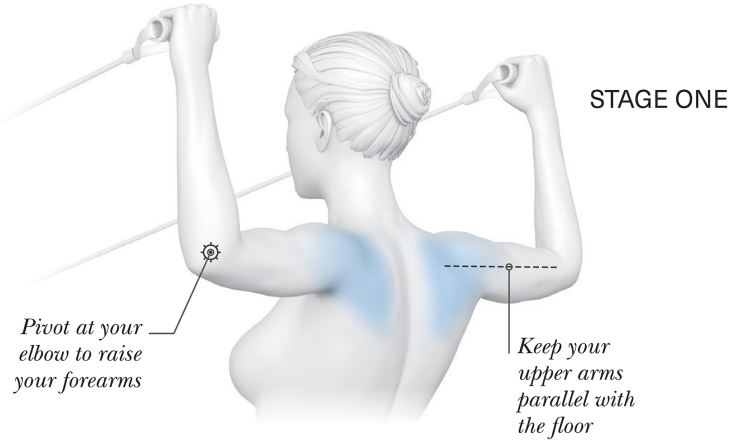
Fix a low-resistance band at shoulder height and stand with a neutral spine and shoulder-width stance. Face toward the band and flex the elbow so your upper arm is parallel with the floor.



Double-tap image to read the labels

STAGE ONE

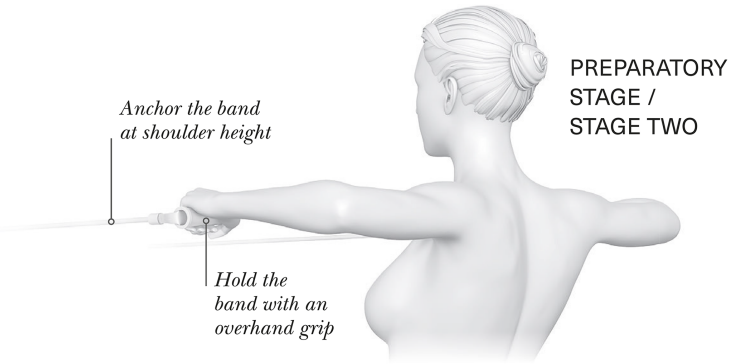
Externally rotate at the elbow – move your forearm so that it's perpendicular to the floor, keeping your upper arm level. Keep your elbow in line with your shoulder throughout the movement.



Double-tap image to read the labels

STAGE TWO

Resist the band's tension as you allow the arm to rotate back toward a neutral position in a controlled manner. Repeat stages 1 and 2 for 5–10 reps.



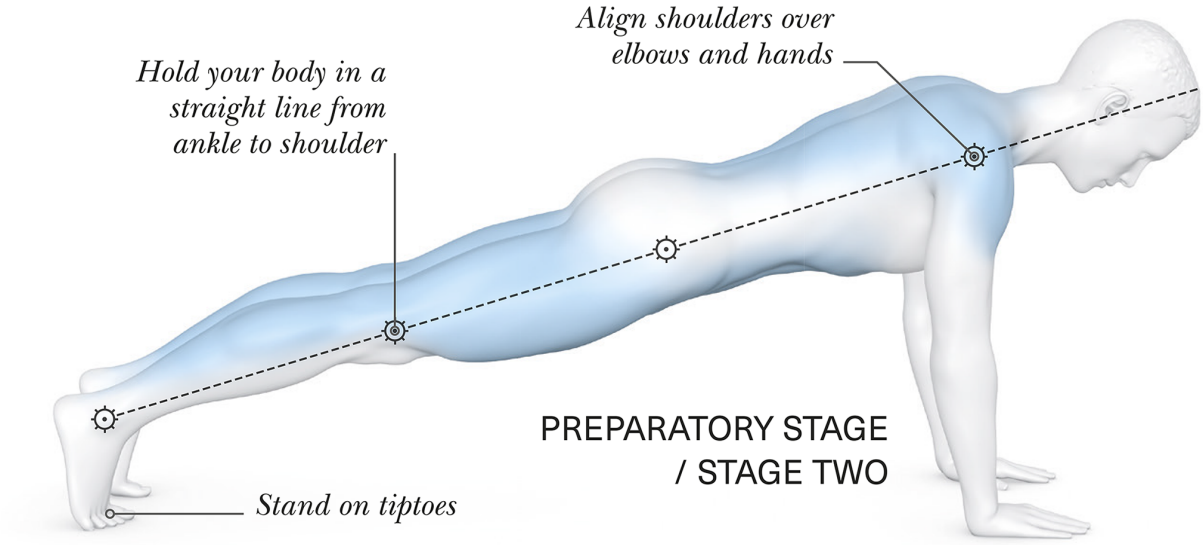
Double-tap image to read the labels

INCHWORM

This mobility exercise offers a superb total body warm-up. It challenges muscle tissue crossing all major joints in the body as you walk your feet in then walk your hands out, priming the body for your workout.

PREPARATORY STAGE

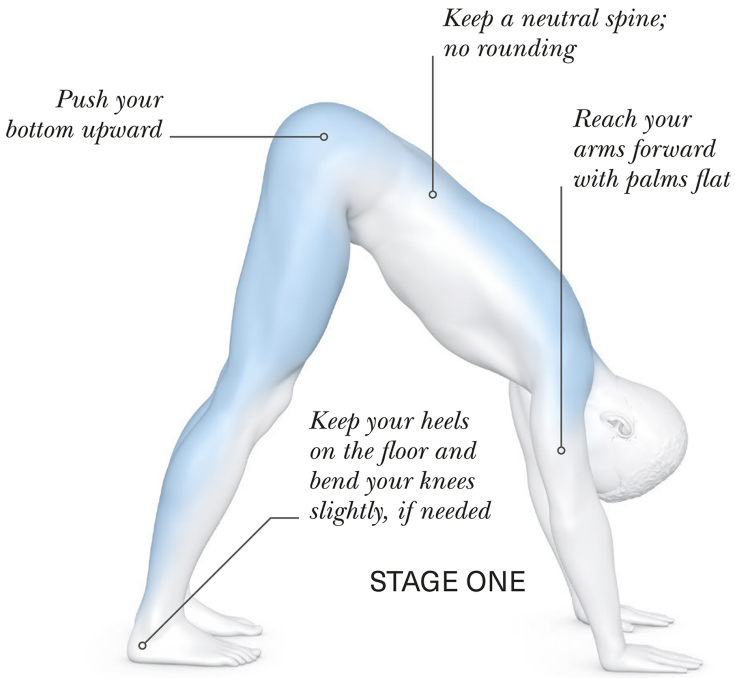
Start off in the push-up high plank position. Engage your core, holding your body in a straight line, and maintain a neutral head position.



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STAGE ONE

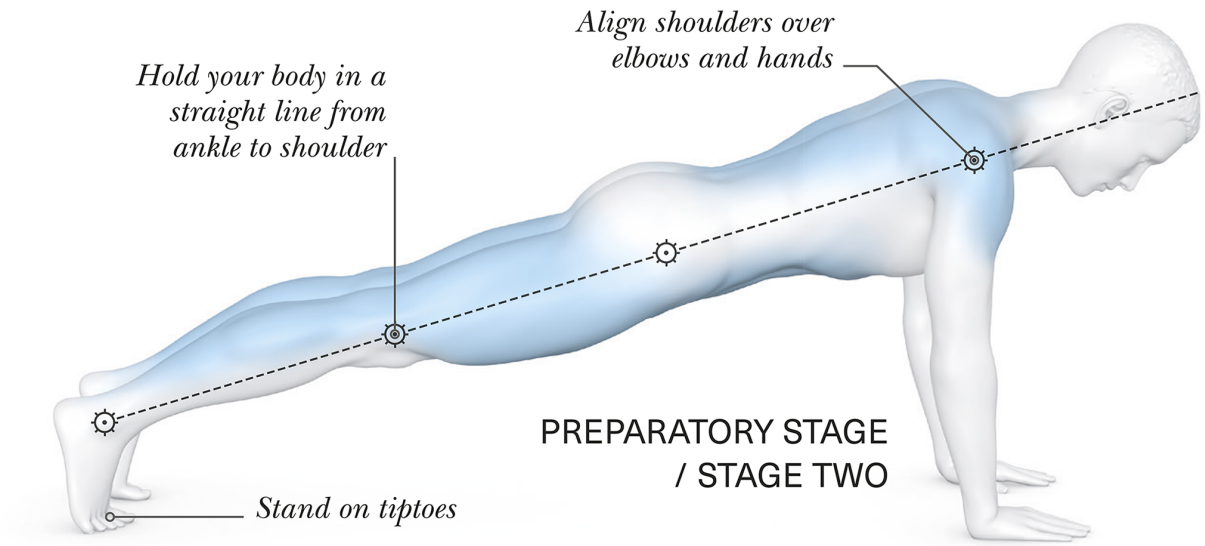
From here, inch your feet up toward your hands one foot at a time, while maintaining a neutral spine and engaged core. Do not round at the back.



ⓘ Double-tap image to read the labels

STAGE TWO

When you reach the final position, return to the starting position by inching your hands forward until your reach the push-up plank. Perform 5–10 reps.



Double-tap image to read the labels

SUPINE HIP **FLEXION WITH BAND**

The hip flexor muscles, most notably the psoas and rectus femoris, aid coordination of pelvic stability, alongside hip flexion. This exercise helps challenge the rectus femoris and psoas in a more contracted position, getting them activated and ready to be loaded on your lower body workouts.

PREPARATORY STAGE

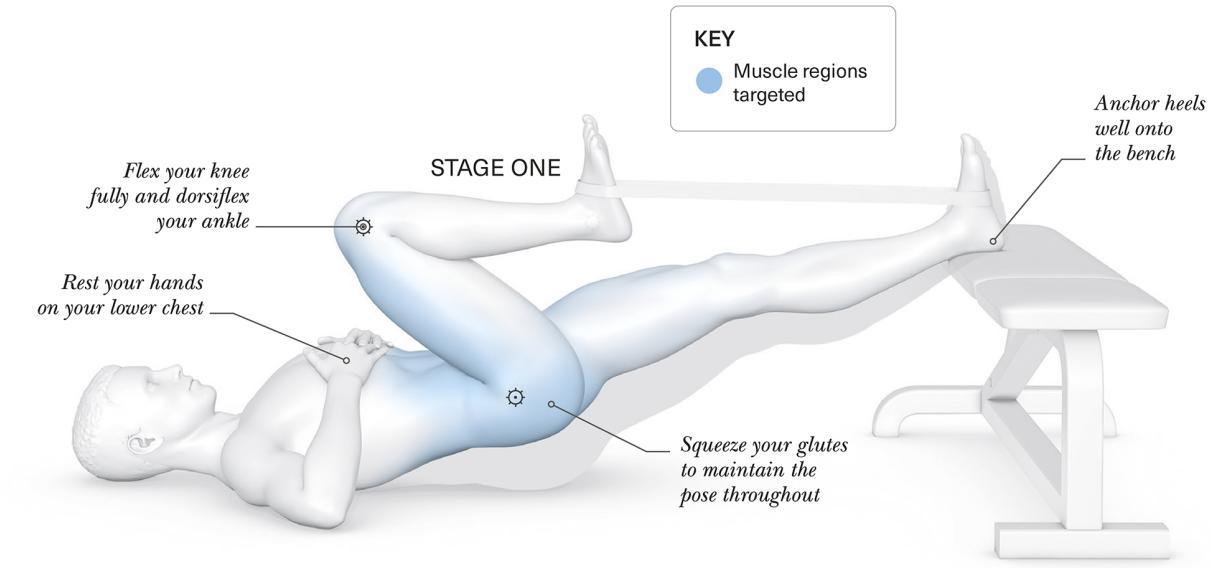
From a supine position with feet on the bench and a resistance band across your feet, raise your hips into a glute bridge; keep your elbows on the floor.

STAGE ONE

While maintaining a glute bridge, flex at the hip and knee to bring the working knee up toward the body, as far as it comfortably goes.

STAGE TWO

With control, extend the same leg and return your foot to the bench. Repeat on the other leg. Repeat stage 1 and stage 2 for 5–10 reps on each side.



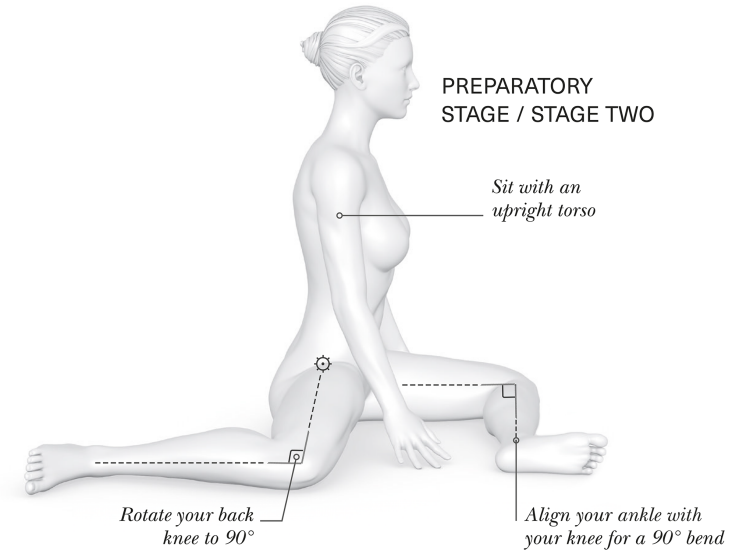
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90/90 HIP STRETCH

This exercise is effective at challenging overall hip mobility – external and internal – and acts as a “hip opener”, helping to combat tight or stiff hips. Having good internal and external rotation at the hip can help alleviate common pain in the hips and lower back.

PREPARATORY STAGE

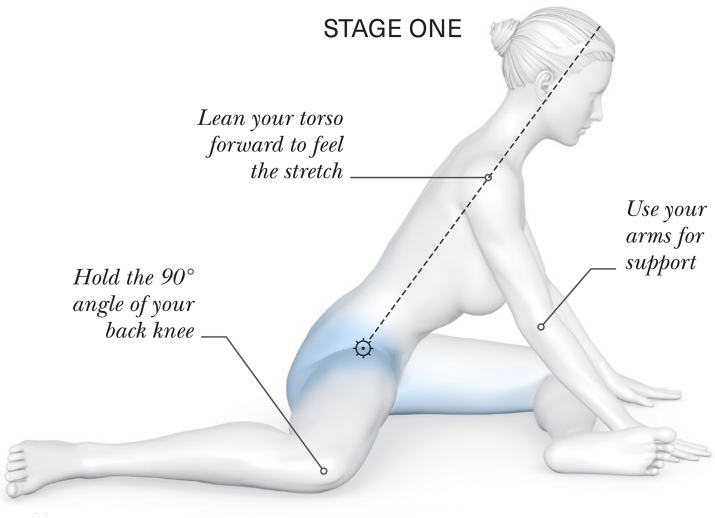
Start seated upright on the floor with both legs bent at 90° – one in front of you with knee internally rotated, the other behind you, externally rotated.



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STAGE ONE

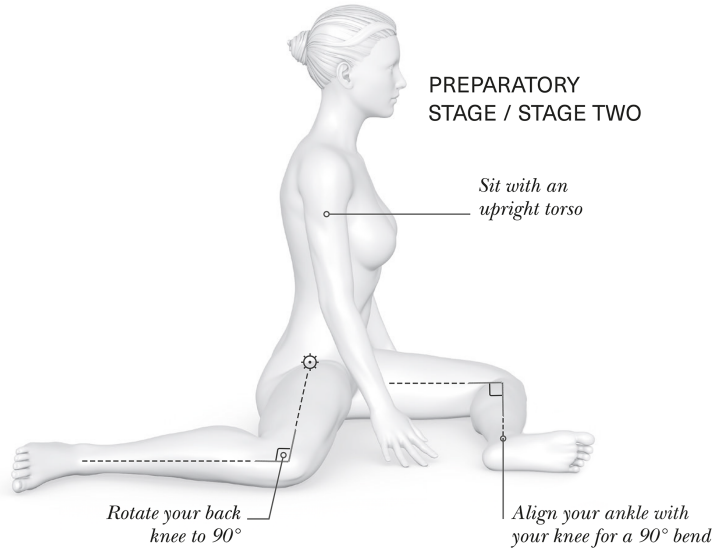
Move your torso to align your belly button with your knee. Lean forward, keeping your chest high, and hold for 3–5 seconds to feel a stretch in the glutes of your lead leg.



ℹ Double-tap image to read the labels

STAGE TWO

Sit up tall to return to the starting position. Repeat stages 1 and 2 for 3–5 reps then repeat on the other side.



ℹ Double-tap image to read the labels

LEG ABDUCTION WITH BAND

This exercise helps warm up the external rotators and abductors of the hip. In a world where people sit for long periods throughout the day, it is important to maintain stability and strength within the hip abductors.

PREPARATORY STAGE

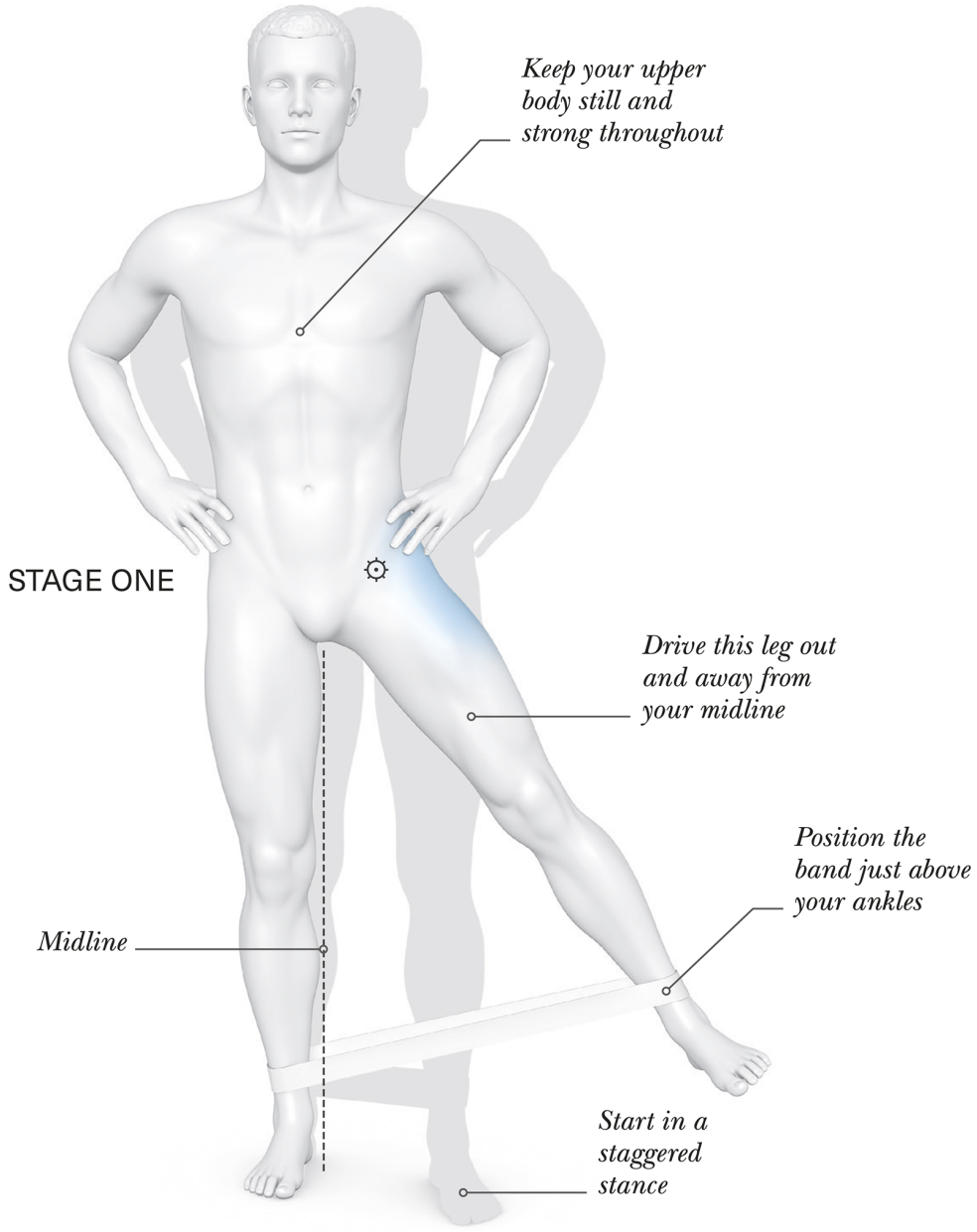
Stand within a resistance band in a staggered stance with your working leg slightly in front of the other. Stand tall with your hands resting on your hips.

STAGE ONE

Engage your core and maintain a neutral spine. Drive the working leg out and away from your midline while keeping your pelvis stable.

STAGE TWO

Return the working leg to the starting position by resisting the band tension in a controlled motion. Repeat stages 1 and 2 for 5–10 reps. You can touch the ground between reps to regain balance.



Double-tap image to read the labels

LEG ADDUCTION WITH BAND

This exercise focuses on warming up the internal rotators and adductors of the hip. The hip adductors get little use during a sedentary life, so this move complements the abduction for healthy hip stability.

PREPARATORY STAGE

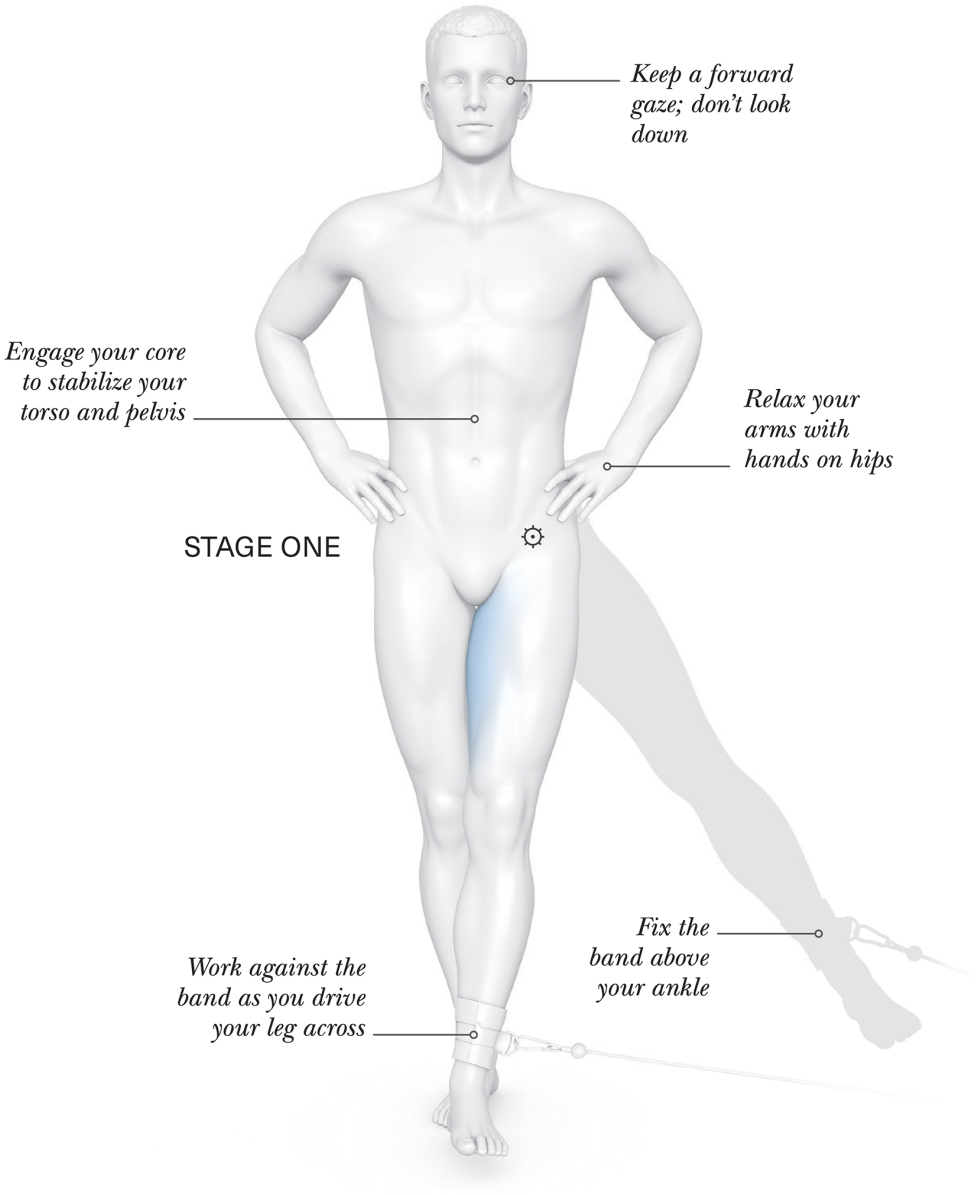
Stand tall with a resistance band attached to your working leg, which is slightly in front of the other. Shift from the band's fixing to get enough resistance.

STAGE ONE

Engage your core and maintain a neutral spine. Drive the working leg in toward the midline of your body while keeping your pelvis stable.

STAGE TWO

Return the working leg to the starting position by resisting the band tension in a controlled motion. Repeat stages 1 and 2 for 5–10 reps. You can touch the ground between reps to regain balance.



Double-tap image to read the labels

COOL-DOWN STRETCHES

Cool-down stretching, also known as passive cool down, can be part of a longer cool-down routine including other low-intensity dynamic activities such as swimming, cycling, and walking. The stretching component of your cool-down routine promotes relaxation and shifts your body into the "rest and digest" state, helping promote recovery and a sense of calm and wellbeing.

SCALENE STRETCH

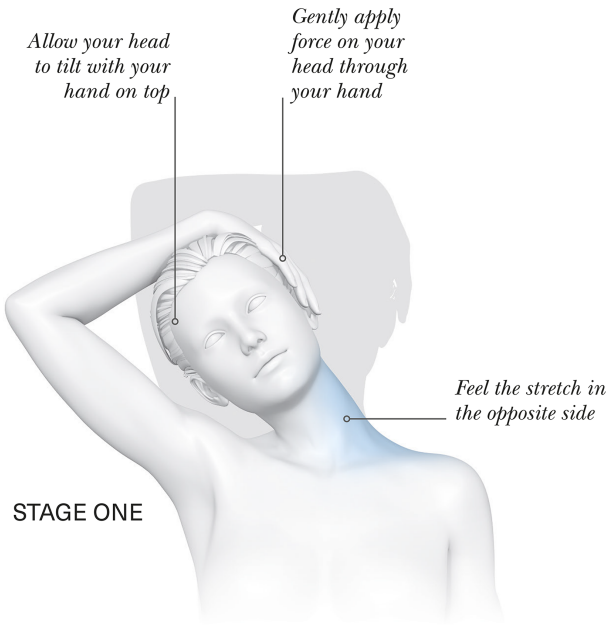
During training, you can place lots of tension on the upper back (trapezius) and muscles of the neck (scalene), either directly or indirectly through stabilization. This stretch helps lengthen those muscles and reduce tension.

PREPARATORY STAGE

Stand tall. Maintain a neutral head position and reach one arm across the top of your head and place it over the top of your ear.

STAGE ONE

Gently apply force through your hand to stretch your neck, pulling on the opposite side of the head.



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STAGE TWO

Return to neutral and then repeat stages 1 and 2 on the other side. On each side, hold for 5 seconds for a total of 3–5 reps.

CHILD'S POSE

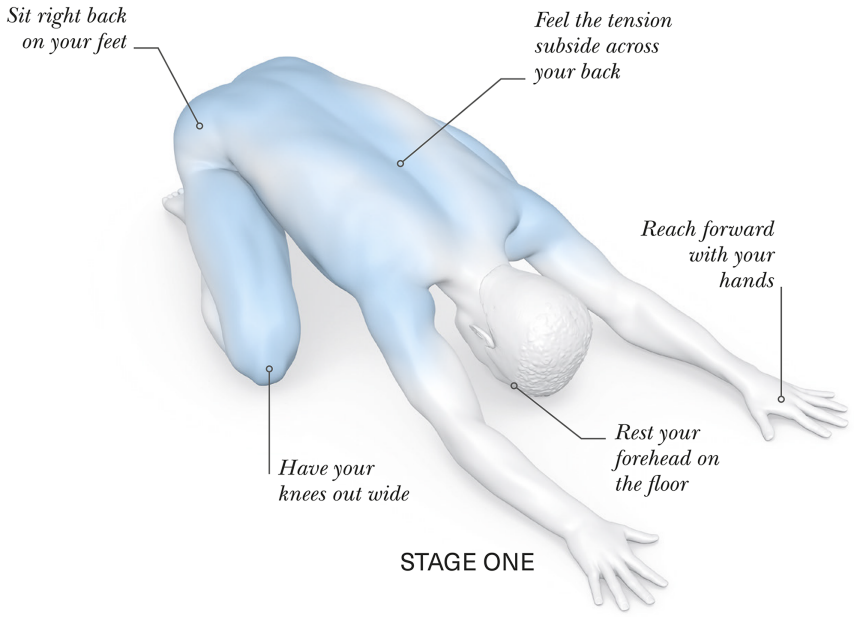
This stretch, with origins in yoga, is performed as a seated pose (or asana). It is a safe way to release tension through the breath while stretching back muscles and also those surrounding joints of the hip, knee, and ankle.

PREPARATORY STAGE

Start in a table-top position (on all fours).

STAGE ONE

Shift your knees out slightly so you can sink your hips back while reaching your hands forward – stretching your back and shoulders. Focus on the breath and do your best to control your breathing as you transition into the seated back position.



Double-tap image to read the labels

STAGE TWO

Return to the starting position by raising your hips up and forward into the table-top position. Repeat for 3–5 controlled reps.

Breathe to help recovery

Slow, controlled, rhythmic breathing helps to stimulate the vagus nerve and promotes rest, relaxation, and recovery. Controlled rhythmic breathing paired with short static stretching can promote recovery and a higher sense of wellbeing as well as elevating your mood. During your stretching session aim to breathe slowly and rhythmically – around 6–10 breaths per minute – which will help you find a calm relaxed state so that you can sink deeper into your stretches.

FORWARD FOLD

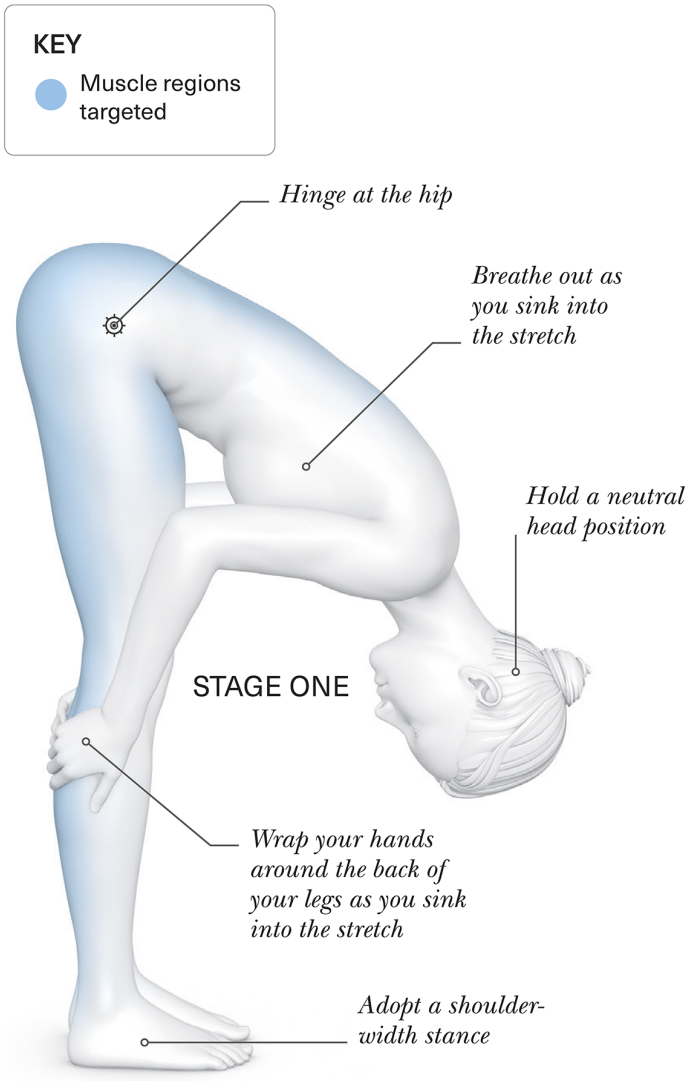
Another yoga-inspired stretch, the forward fold is a standing pose (asana) that is easy to match to your own limitations or needs. This excellent stretch relieves tension in the lower back and hips.

PREPARATORY STAGE

Stand tall with your feet shoulder-width apart.

STAGE ONE

Flex at the hips, bending your torso over toward 45°. Keep your core engaged and spine neutral with maybe a slight rounding at the upper back. Feel a light to moderate stretch in the lower back, hamstrings, and glutes.



Double-tap image to read the labels

STAGE TWO

Control your breathing, exhaling on the way down and inhaling on the way up. Perform 3–5 reps, holding each stretch for 5–10 seconds.

QUAD STRETCH

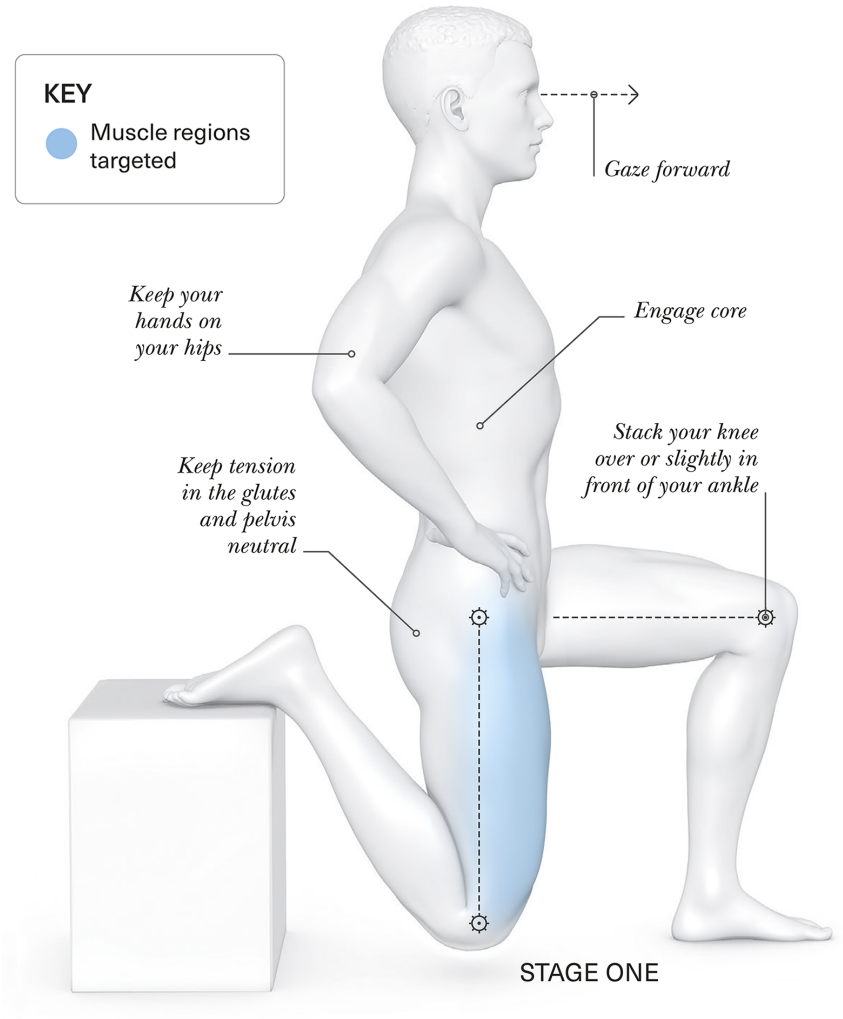
Also known as the “couch stretch”, this cool-down stretch helps relieve tension and works on a limited range of motion in the hip flexors. This stretch helps mobilize and stabilize the muscles surrounding the pelvis.

PREPARATORY STAGE

Stand tall with a block about 60cm (24in) high positioned behind one leg. Place your foot on top of the block.

STAGE ONE

Drop your elevated back knee toward the floor, keeping the same leg’s thigh perpendicular to the floor. As you descend, feel the stretch down the quadriceps muscle of the working leg.



Double-tap image to read the labels

STAGE TWO

Return to the upright pose, then complete 3–5 controlled reps. Repeat on the other leg.

◀ CONTENTS



One of the most challenging parts of strength training is understanding how to take a grouping of exercises and turn them into a well-structured programme to achieve your goals. This section dives right into the most important training principles, how to implement and progress them, with examples of putting it all together to build muscle, strength, and endurance.

VARIABLES WITHIN STRENGTH TRAINING
THE TRAINING PROGRAMMES
MUSCLE BUILDING, BEGINNER
MUSCLE BUILDING, ADVANCED
STRENGTH, BEGINNER
STRENGTH, ADVANCED
STRENGTH ENDURANCE, BEGINNER
STRENGTH ENDURANCE, ADVANCED

VARIABLES WITHIN STRENGTH TRAINING

The training programmes in this book are built around the following key variables: training volume, training intensity, exercise selection, and fatigue management. In addition, the programmes are organized by difficulty and by frequency, so you can choose a session based on your experience level and how much time out of your week you can dedicate to training.

TRAINING VOLUME

Volume refers to the amount of exercise performed over a given period of time, usually a training session or week of training. It is often represented by the number of reps for a given number of sets at a given load (weight).

As you gain experience, you can further adjust volume by altering the specific exercises you select, their range of motion and resistance profile (at what point in the rep the movement is hardest), and the tempo and rest periods used.

Training volume by training programme

Training can be geared at building muscle, increasing strength endurance, or increasing strength; training volume will vary depending on which of these three is the end goal of the training. Volume can be progressed by adding reps or load, or by adding a set.

Muscle building

Focus on gradually increasing total training volume by load, reps, or sets (see Total weekly volume). The goal is to increase the total volume week-on-week for the target muscle group.

Strength

Focus on volume of intensity per training session or training week.The goal is to work up to higher relative intensities (% of 1RM) to train the nervous system.

Strength endurance

Focus on the density of work – the amount of work performed in a given amount of time. The goal is to increase the total density per session, so you do more work in the same time.

Total weekly volume

Each training week will be measured by the amount of training volume performed per muscle group.

EXAMPLE

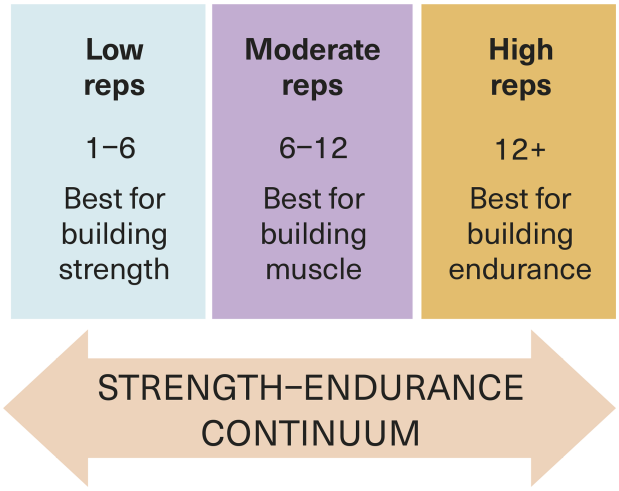
If you perform 4 sets of chest exercises per workout, and you work out 3 times per week, then you will perform 12 total sets of chest exercises: this is your total weekly volume for chest workouts.

4x sets x @ **3x** per week
= **12x sets** per week for specific body part

TRAINING **INTENSITY**

Intensity of load is expressed as a percentage of the maximum weight you can support in one rep of an exercise (known as 1 rep maximum or 1RM).

Training load will dictate how many reps you can do in a set. Higher intensity most often correlates with lower reps (6 or fewer), moderate loads with moderate reps (6–12) and lower loads with higher reps (12–20 or more). When your goal is to build strength, lower rep ranges are best to maximize intensity. For muscle-building, use moderate intensity, and for strength endurance, lighter intensity.



ⓘ Double-tap image to read the labels

EXERCISE **SELECTION**

Each exercise trains a muscle at a specific part of its range of motion. Different exercises can also challenge a muscle more eccentrically or concentrically (see Muscular Anatomy).

For example, a back squat challenges the lengthened range of the quadriceps, whereas a leg extension targets their mid-shortened range, even with the same load and rep number. Different machines also challenge muscles differently. It's important to find exercises that work for your skill level, structure, and mechanics.

RANGE OF MOTION

The contribution of muscles changes depending on joint angle and exercise. At each point along the range of motion, different parts of a muscle will be under demand; this is why it is important to use the full range of motion possible within your exercise technique, keeping in mind your individual limitations.

TRAINING TARGET MUSCLES

Consider your abilities when choosing exercises; for instance, adjusting the cable height in a chest fly may allow you to better rotate your shoulders.



FATIGUE MANAGEMENT

Managing fatigue is crucial for maximizing muscle growth and strength as well as lowering your risk of injury.

PROXIMITY TO FAILURE

This research-based approach to managing fatigue uses a number, often given on a 1–10 scale (see RIR), to represent "reps in reserve" (RIR): how many reps you have "left in the tank" on a given set. It correlates with your rate of perceived exertion (RPE).

AUTOREGULATION

This refers to the concept of adjusting your training based on the feel of the load on any given day, such as by making a session easier if you feel particularly fatigued. An individualized approach will keep you motivated and prevent injury.

DELOAD

A deload is a light week or back-off week, during which you train at the minimum volume needed to maintain muscle or strength, to facilitate recovery and muscle repair. The harder you have trained, the longer the deload you will need before you can return to, or build on, that level. Every fifth week is an ideal time in a training schedule for a deload. Beginners should reduce loads by around 10–20% for this week, while those at a more advanced level should reduce set volume by around 30–50% of where it peaked over the previous weeks of training, as well as reducing RIR by 2 points.

RIR-based RPE scale

SCORE	DESCRIPTION
10	Maximal effort
9.5	No RIR, but could increase load
9	1 RIR
8.5	Definitely 1, maybe 2 RIR
8	2 RIR
7.5	Definitely 2, maybe 3 RIR
7	3 RIR
5-6	4-6 RIR
3-4	Light effort
1-2	Little to no effort

The importance of rest

Rest is time between sets of an exercise, crucial for recovery. In advanced training programmes the amount of rest taken should vary from 15 seconds up to 5 minutes, depending on your training training goal and according to intensity, set duration, and training experience. Beginners to strength training may want to use the higher end of the range to ensure training response is appropriately managed.



TRAINING **FREQUENCY**

Training frequency represents how many times in a training week you are training a given muscle group (see the example).

As you need to reach a determined training volume per muscle group per week to gain muscle or strength, training more days per week allows you to vary the work.

TRAINING MORE OFTEN

You can train each muscle group more frequently and with fewer sets per day.

TRAINING LESS OFTEN

You can have more days of recovery between sessions for a specific muscle group, but more sets for that muscle group per session.

As well as manipulating training frequency, you can also simply manipulate training volume per session by adding reps, load, or sets to your current programme. Understand that everything you add increases the total stress of that training session.

TRAINING **PROGRESSION**

Progressive overload is defined as the proactive addition of stress or stimulus (in the form of sets, reps, or load) over time (see graphs), used to help your training progress.

Being able to do more reps of a given weight or lift heavier loads confirms that overload has occurred. There are several factors you can change in order to ensure your training progresses over time.

ADDING REPS AND LOAD

A repetition, or rep, is one complete motion, eccentric and concentric, of an exercise. Adding reps or extra weight are good ways to progress your training, by increasing the amount of tension placed on the target muscle(s). The more tension, the more muscle tissue is active, both from a contractile and a metabolic perspective.

ADDING SETS

A popular way to progress your training volume or intensity is to add whole sets into the workout.

A higher volume provides an increased ability to boost muscle growth, but only to a point: if you exceed your maximum recoverable threshold you will only see diminishing returns.

PROGRESSIVE REPS IN RESERVE (RIR)

Monitoring your RIR focusses on increasing the overall fatigue in a programme by raising the total work intensity. Keeping a number of RIR helps manage fatigue, and ensures consistency in performance (see Fatigue management).

RECOVERY

Recovery is one of the most important variables of training. Since strength training breaks down muscle fibres (see How muscles grow), maximizing recovery time helps your body repair itself to build muscle, strength, and endurance. Without adequate recovery, your training performance will suffer and you will not be able to properly adapt to your training. This is why rest days are so important, alongside good-quality sleep, nutrition, and stress management.

Progressive overload

ADDING REPS AND LOAD

If you reach a plateau adding weight or reps to your sets, boost volume by adding entire extra sets.

ADDING SETS

The productive volume range is somewhere between 10 and 18 sets per week for most people.

PROGRESSIVE RIR

Beginners should stay 2–4 reps shy of failure; advanced trainees can reduce RIR by 1 point per week.

RECOVERY

Schedule rest days into your programme to avoid your training performance suffering.

THE TRAINING PROGRAMMES

Training sessions are governed by training split – how you choose to organize your training week and sessions. There are three programmes aimed at a beginner and three at an advanced level, with options to train more or less often.

TRAINING SPLIT

Based on your experience level, training goal, and available training time, you can choose from workouts 3x, 4x, or 5x a week, varying between beginner's and advanced programmes. Find the programme that matches your goal – muscle building, strength, or strength endurance.

3x per week – this is a **full body training split**, best distributing the volume between muscle groups throughout the training week. It focusses on major muscle groups and multi-joint, integrated exercises to place tension on smaller muscle groups, such as the shoulders.

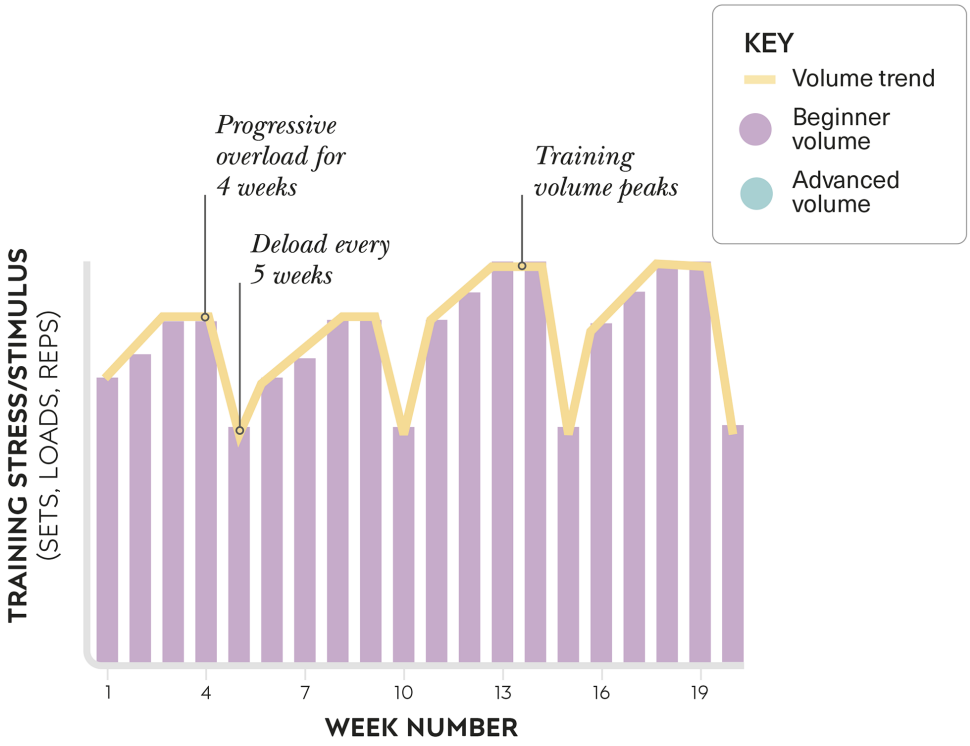
4x per week – this is a **half body training split**. With the added training day, you can split the training volume up per muscle group allowing for more volume per muscle group in each session.

5x per week – this will be a **one-third body training split**. Each day trains about one-third of the body, placing more volume per muscle group per workout with less weekly training frequency per muscle group.

ADJUSTING TRAINING VOLUME WITHIN PROGRAMMES

BEGINNER PROGRAMMES

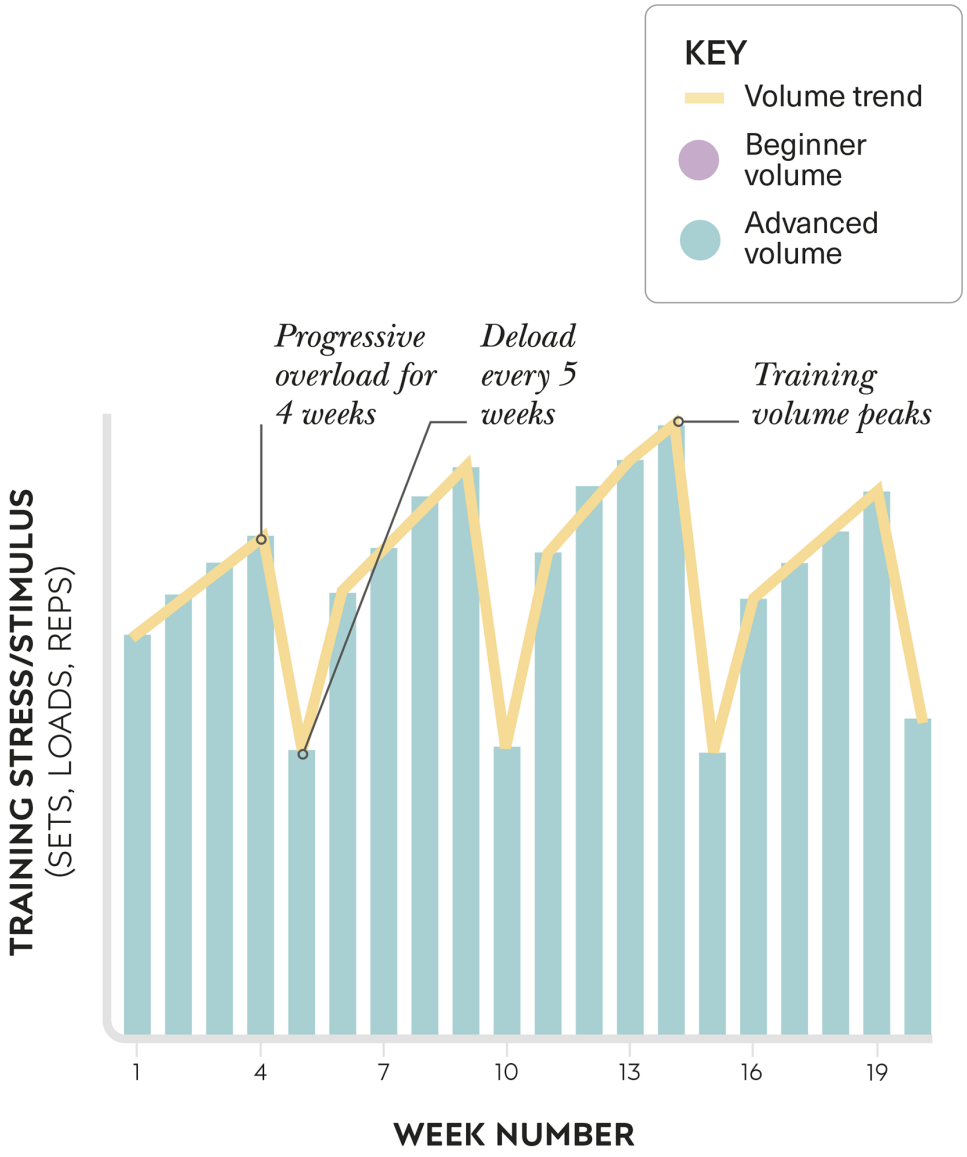
In training programmes aimed at beginners, there is progressive overload for four weeks, then a drop (deload) in the fifth week for recovery; this pattern is then repeated. Training volume builds gradually, peaking in week 14.



Double-tap image to read the labels

ADVANCED PROGRAMMES

Advanced training follows the same pattern as above, but with higher training volume throughout; increase in volume week-on-week is also greater, allowing for more progressive overload. In weeks 16–19 the amount of stress dips back down to facilitate recovery.



Double-tap image to read the labels

MUSCLE BUILDING BEGINNER

Training to build muscle via the process of hypertrophy is rooted in performing high-quality repetitions for a certain amount of volume at a certain level of intensity or proximity to failure.

Training all the way to failure on every set is not productive long term. Instead, aim to train to near failure on each set, using the rate of perceived exertion (RPE) scale on to gauge your reps in reserve (RIR). Training within 4–5 reps of failure has been shown to contribute enough stimulus to promote muscle growth.

Begin each workout by warming up. Where indicated, you can choose a variation of the given exercise, according to your preference and situation.

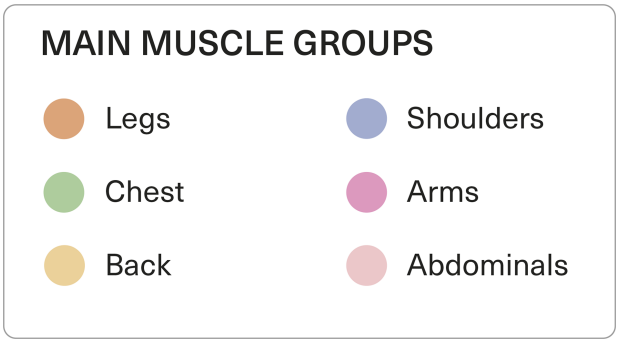
For all workouts

Any beginner's muscle-building workout uses the following reps, sets, rest between sets, RIR, and tempo guidance, however often you're training:

8–10 REPS
4 SETS
60–90 SECONDS REST
3–4 RIR
CONTROLLED TEMPO

Guidance on tempo

Tempo is the rhythm with which you perform each rep. "Controlled" tempo means the pace should be monitored with each rep: complete the eccentric phase with a controlled 2–3-second count and the concentric with a 1-second count to maintain proper technique and tension on the muscle.



MUSCLE BUILDING—3X PER WEEK

WORKOUT **1**

EXERCISE
Barbell back squat or variation
Leg curl (seated or lying)
Dumbbell bench press or Push-up
Wide-grip vertical pulldown or Pull-up
Dumbbell shoulder press
Front plank with rotation

WORKOUT **2**

Barbell bench press or variation
Romanian deadlift
Neutral-grip horizontal row
Machine or dumbbell shoulder press
Leg extension or variation
TVA ball crunch or Cat–cow kneeling crunch

WORKOUT **3**

Traditional deadlift or Step up with dumbbells
Neutral-grip vertical pulldown or Chin-up
Mid-cable chest fly or Machine chest fly
Leg curl (seated or lying)
Machine or dumbbell shoulder press
Cable rotational oblique twist

MUSCLE BUILDING—4X PER WEEK

WORKOUT **1**

EXERCISE
Barbell bench press or variation
Leg press
Rope triceps pushdown or variation
Dumbbell lateral raise or variation
Cable rope crunch

WORKOUT **2**

Neutral-grip vertical pulldown or Chin-up
Leg curl or variation
Dumbbell glute bridge or variation
Dumbbell biceps curl or variation
Leg extension or variation

WORKOUT **3**

Calf raise
High–low cable chest fly or variation
Dumbbell triceps extension or variation
Dumbbell shoulder press or variation
Cable rotational oblique twist

WORKOUT **4**

Neutral-grip horizontal row
Romanian deadlift
Dumbbell glute bridge or variation
Banded biceps curl
Seated calf raise

MUSCLE BUILDING—5X PER WEEK

WORKOUT **1**

EXERCISE
Incline barbell bench press or variation
Neutral-grip vertical pulldown
Prone bench rear deltoid raise
Dumbbell biceps curl
Rope triceps pushdown or Close-grip barbell bench press
Cable rope crunch

WORKOUT **2**

Romanian deadlift
Hack squat
Dumbbell glute bridge or variation
Leg extension
Calf raise

WORKOUT **3**

Dumbbell shoulder press or variation
Dumbbell lateral raise or variation
Banded biceps curl
Cross-cable triceps pressdown
Cable rotational oblique twist
Decline abdominal crunch

WORKOUT **4**

Neutral-grip horizontal row
Wide-grip vertical pulldown
Dumbbell bench press or Push-up
Dumbbell bent-over row
Chest or back exercise of choice

WORKOUT **5**

Leg press or Dumbbell squat
Leg extension or variation
Leg curl (seated or lying)
Dumbbell glute bridge or variation
Prone bench rear deltoid raise
Dumbbell lateral raise or variation

MUSCLE BUILDING ADVANCED

In these advanced muscle-building programmes, the progression is mostly achieved through increasing training volume and expanding exercise selection.

A wider variety of exercises appear in these advanced training programmes compared with the beginner workouts, and volume is upped to increase the metabolic stress and tension placed on muscles. As with beginner programmes, you should aim to train to near failure on each set by gauging your RIR or RPE. Pay attention to the tempo, or rhythm, required for each exercise.

For all workouts

Any advanced muscle-building workout uses the following rest between sets and RIR however often you're training:

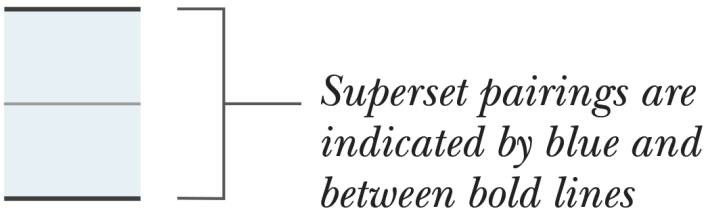
60–90 SECONDS REST

2–3 RIR

Guidance on tempo

In more advanced programmes, tempo is expressed as a ratio of four numbers that correspond to the duration, in seconds, of each stage in a rep: eccentric contraction, rest at the bottom of the rep, concentric contraction, and rest at the top of the rep. A tempo of 3011, for instance, requires a controlled 3-second count during eccentric contraction (such as descending in a squat), 0 seconds of rest at the bottom of the rep, a controlled 1-second count of concentric contraction (such as rising explosively from a squat), and 1 second of hold at the top of the rep, where you contract the target muscle. Other common tempos used in the training programmes in this book are 3010 and 3110.

FOR GUIDANCE ON SUPERSETS



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MAIN MUSCLE GROUPS

- Legs
- Shoulders
- Chest
- Arms
- Back
- Abdominals

MUSCLE BUILDING—3X PER WEEK

WORKOUT **1**

EXERCISE	SETS	REPS	TEMPO
Barbell back squat or Leg press	4	6–8	3010
Leg curl (seated or lying)	4	6–8	3010
DB bench press or Barbell bench press	4	6–8	3010
Wide-grip vertical pulldown or Pull-up	4	6–8	3010
DB shoulder press	4	6–8	3010
Front plank with rotation	4	6–8	Controlled

WORKOUT **2**

Barbell bench press or DB bench press	4	6–8	3010
Romanian deadlift	4	6–8	3010
Neutral-grip horizontal row	4	6–8	3010
Machine or DB shoulder press	4	6–8	3010
Leg extension	4	6–8	3010
TVA ball crunch or variation	4	6–8	Controlled

WORKOUT **3**

Traditional deadlift or variation	4	8–10	3010
Neutral-grip vertical pulldown or Chin-up	4	8–10	3010
Mid-cable chest fly or Machine chest fly	4	8–10	3010
Leg curl (seated or lying)	4	8–10	3010
Machine shoulder press or Front delt shoulder press	4	8–10	3010
Cable rotational oblique twist	4	8–10	Controlled

MUSCLE BUILDING—4X PER WEEK

WORKOUT **1**

EXERCISE	SETS	REPS	TEMPO
DB bench press or var.	4	6–8	3110
Barbell back squat or Leg press	5	6–8	3010
Cross-cable triceps pressdown	4	8–10	3011
High–low cable chest fly	4	8–10	3011
DB lateral raise or var.	4	8–10	3010
DB triceps extension or variation	4	8–10	3010
Cable rope crunch	5	8–10	Controlled

WORKOUT **2**

Neutral-grip vertical pulldown or Chin-up	4	6–8	3010
Lying leg curl or var.	5	6–8	3011
Barbell glute bridge or variation	4	6–8	3011
Machine biceps curl	4	6–8	3011
DB biceps curl or var.	4	8–10	3011
DB bent-over row	4	8–10	3010
Calf raise or variation	5	8–10	Controlled

WORKOUT **3**

Leg extension or var.	5	8–10	3011
Mid-cable chest fly	4	8–10	3010
DB triceps extension or variation	4	8–10	3110
Barbell overhead shoulder press or variation	4	8–10	3010
DB lateral raise or var.	4	8–10	3010
Cable rotational oblique twist	5	6–8	Controlled

WORKOUT **4**

Neutral-grip horizontal row	4	6–8	3010
Romanian deadlift	5	6–8	3010
Barbell glute bridge or variation	4	6–8	3011
Banded biceps curl	4	8–10	3011
Seated calf raise	5	8–10	3011

MUSCLE BUILDING—5X PER WEEK

WORKOUT **1**

EXERCISE	SETS	REPS	TEMPO
Incline DB bench press or var.	4	6–8	3110
Neutral-grip vertical pulldown	4	6–8	3010
DB rear delt fly	4	8–10	3011
DB chest fly	4	8–10	3010
DB biceps curl	4	8–10	3011
Rope triceps pushdown	4	8–10	3011
Face-away standing crunch	4	8–10	Controlled

WORKOUT **2**

Romanian deadlift	4	6–8	3010
Hack squat	3	8–10	3010
Barbell glute bridge or variation	4	8–10	3011
Leg curl	4	8–10	3011
Leg extension	3	8–10	3011
Calf raise or Leg press calf raise	4	8–10	3011

WORKOUT **3**

Machine or DB shoulder press	4	6–8	3110
DB lateral raise or var.	4	8–10	3010
DB front raise or var.	4	8–10	3010
Banded biceps curl	4	8–10	3011
DB rear delt fly or var.	4	8–10	3011
Cross-cable triceps pressdown	4	8–10	3011
Side plank with rotation	4	8–10	Controlled
Stir-the-pot Swiss ball	4	8–10	Controlled

WORKOUT **4**

Neutral-grip horizontal row	4	6–8	3010
Vertical pulldown	4	8–10	3011
DB bench press or Push-up	3	8–10	3110
Low–high cable chest fly	3	8–10	3011
DB trap shrug	4	8–10	3010
Chest or back exercise of choice	4	8–10	Controlled

WORKOUT **5**

Barbell back squat or Hack squat	4	8–10	3110
Leg extension or var.	4	8–10	3011
Leg curl (seated or lying)	4	8–10	3010
DB glute bridge or var.	4	8–10	3011
Prone bench rear delt raise	4	8–10	3011
DB lateral raise or var.	4	10–12	3010
Cable rope crunch or Hanging knee raise	4	8–10	Controlled

STRENGTH BEGINNER

Training with the goal of building muscular strength requires high-intensity (high-load) training paired with lower rep ranges and longer rest periods.

In strength-specific programmes, the intent is to use the muscle mass you have to generate contractile force, and to train your nervous system, allowing it to recruit and activate muscles to generate force more intensively and efficiently (see Neural adaptations). Training for strength is also an expression of skill and coordination.

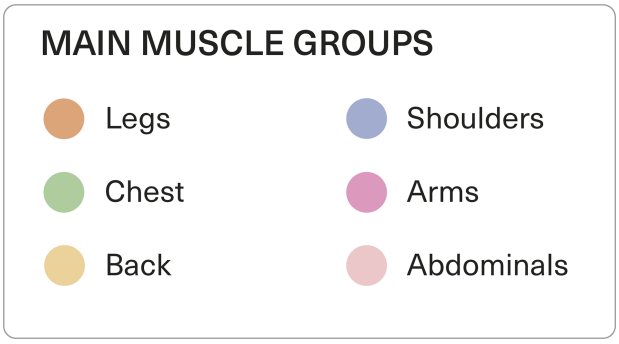
In these programmes, you should complete the main exercise with the goal of increasing the load used with each set. Use warm-up sets on main exercises as needed to ready your body for heavier loads. Where indicated, you can choose a variation of the given exercise, according to your preference and situation.

For all workouts

Any beginner's strength workout uses the following reps, sets, rest between sets, RIR, and tempo guidance, however often you're training:

CONTROLLED TEMPO

1 MINUTE REST for exercises with **2** SETS AND **2–3** MINUTES REST for others, except for those marked *, which should have **2–5** MINUTES REST



STRENGTH—3X PER WEEK

WORKOUT **1**

EXERCISE	SETS	REPS	RIR
Machine horizontal row	2	6–8	3–4
Machine shoulder press	2	6–8	3–4
Barbell bench press or DB bench press *	5	5	2–3
Barbell overhead shoulder press or DB shoulder press	3	6	2–3
Cross-cable triceps pressdown or variation	3	6	2–3

WORKOUT **2**

Calf raise	2	6–8	3–4
DB glute bridge	2	6–8	3–4
Barbell back squat or Hack squat *	5	5	2–3
Leg press	3	6	2–3
Seated calf raise	3	6	2–3

WORKOUT **3**

Calf raise	2	6–8	3–4
DB glute bridge	2	6–8	3–4
Barbell bent-over row or Machine horizontal row *	5	5	2–3
Neutral-grip vertical pulldown	3	6	2–3
DB biceps curl or Machine biceps curl	3	6	2–3

STRENGTH—4X PER WEEK

WORKOUT **1**

EXERCISE	SETS	REPS	RIR
Calf raise	2	6–8	3–4
DB glute bridge	2	6–8	3–4
Barbell back squat or Hack squat *	5	5	2–3
Leg press	3	6	2–3
Leg extension	3	6	2–3
Seated calf raise	3	6	2–3

WORKOUT **2**

Machine horizontal row	2	6–8	3–4
Machine shoulder press	2	6–8	3–4
Barbell bench press or DB bench press *	5	5	2–3
Barbell overhead shoulder press or DB shoulder press	3	6	2–3
Mid-cable chest fly or DB lateral raise	3	6	2–3
Cross-cable triceps pressdown or variation	3	6	2–3

WORKOUT **3**

Calf raise	2	6–8	3–4
Walking lunge with DBs	2	6–8	3–4
Romanian deadlift *	5	5	2–3
Leg curl (seated or lying)	3	6	2–3
Barbell glute bridge or variation	3	6	2–3
Calf raise	3	6	2–3

WORKOUT **4**

Banded biceps curl	2	6–8	3–4
Wide-grip vertical pulldown	2	6–8	3–4
Barbell bent-over row or Machine horizontal row *	5	5	2–3
Neutral-grip vertical pulldown	3	6	2–3
Prone bench rear delt raise	3	6	2–3
DB biceps curl or Machine biceps curl	3	6	2–3

STRENGTH—5X PER WEEK

WORKOUT **1**

EXERCISE	SETS	REPS	RIR
Calf raise	2	6–8	3–4
DB glute bridge	2	6–8	3–4
Barbell back squat or Hack squat *	5	5	2–3
Leg press	3	6	2–3
Leg extension	3	6	2–3
Seated calf raise	3	6	2–3

WORKOUT **2**

Machine horizontal row	2	6–8	3–4
Machine shoulder press	2	6–8	3–4
Barbell bench press or DB bench press	5	5	2–3
Barbell overhead shoulder press or DB shoulder press	3	6	2–3
Mid-cable chest fly or DB lateral raise	3	6	2–3
Cross-cable triceps pressdown or variation	3	6	2–3

WORKOUT **3**

Calf raise	2	6–8	3–4
Walking lunge with DBs	2	6–8	3–4
Romanian deadlift *	5	5	2–3
Leg curl (seated or lying)	3	6	2–3
Barbell glute bridge or var.	3	6	2–3
Calf raise	3	6	2–3

WORKOUT **4**

Banded biceps curl	2	6–8	3–4
Wide-grip vertical pulldown	2	6–8	3–4
Barbell bent-over row or Machine horizontal row *	5	5	2–3
Neutral-grip vertical pulldown	3	6	2–3
Prone bench rear delt raise	3	6	2–3
DB biceps curl or Machine biceps curl	3	6	2–3

WORKOUT **5**

Machine horizontal row	2	6–8	3–4
Machine shoulder press	2	6–8	3–4
Incline DB bench press or Mid-cable chest fly *	5	6–8	2–5
DB or Machine shoulder press	3	6–8	2–3
DB lateral raise	3	6–8	2–3
Rope triceps pushdown or variation	3	6–8	2–3

STRENGTH ADVANCED

These advanced strength-focussed programmes achieve progression through increasing training volume and expanding exercise selection.

Building strength at a more advanced level is achieved primarily through upping the load used – as with the beginner programmes, you should aim to ascend load with each set working up to peak intensity on the last set of each exercise within each workout. Again, use warm-up sets as needed on main exercises to acclimatize to heavier loads.

For all workouts

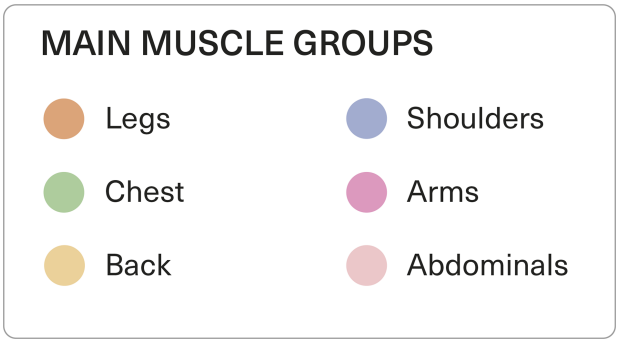
Any advanced muscle-building workout uses the following rest between sets and RIR however often you're training:

60 SECONDS Rest for exercises with 2 sets, **2–3** MINUTES REST for those with 4 sets, and **2–5** MINUTES for those with **5** SETS

FOR GUIDANCE ON TEMPO

Biasing muscle groups

Many of us have particular muscle groups that we wish to improve. Once you have built a solid foundational base of muscle and strength, you can start to bias training volume toward your target muscle groups, by increasing the number of sets you dedicate to them in each training week. Watch out that you don't overshoot your limits: if you add something for your goal muscle group(s), reduce volume on another body part to compensate.



STRENGTH—3X PER WEEK

WORKOUT **1**

EXERCISE	SETS	REPS	RIR	TEMPO
Machine horizontal row	2	6–8	3–4	Controlled
Machine shoulder press	2	6–8	3–4	Controlled
Barbell bench press or DB bench press	5	5	2	3110
Barbell overhead shoulder press or DB shoulder press	4	6	2	3110
Cross-cable triceps pressdown	4	6	2	3110

WORKOUT **2**

Calf raise	2	6–8	3–4	Controlled
DB glute bridge	2	6–8	3–4	Controlled
Barbell back squat or Hack squat	5	5	2	3110
Leg press	4	6	2	3110
Seated calf raise	4	6	2	3110

WORKOUT **3**

Banded biceps curl	2	6–8	3–4	Controlled
Wide-grip vertical pulldown	2	6–8	3–4	Controlled
Barbell bent-over row or Machine horizontal row	5	5	2	3110
Neutral-grip vertical pulldown	4	6	2	3110
DB biceps curl or Machine biceps curl	4	6	2	3010

STRENGTH BUILDING—4X PER WEEK

WORKOUT **1**

EXERCISE	SETS	REPS	RIR	TEMPO
Calf raise	2	6–8	3–4	Controlled
DB glute bridge	2	6–8	3–4	Controlled
Barbell back squat or Hack squat	5	5	2	3110
Leg press or Trap bar deadlift	4	6	2	3110
Leg extension	4	6	2	3010
Seated calf raise	4	6	2	3110

WORKOUT **2**

Machine horizontal row	2	6–8	3–4	Controlled
Machine shoulder press	2	6–8	3–4	Controlled
Barbell or DB bench press	5	5	2	3110
Barbell overhead press or DB shoulder press	4	6	2	3110
Mid-cable chest fly or DB lateral raise	4	6	2	3010
Cross-cable triceps pressdown	4	6	2	3110

WORKOUT **3**

Calf raise	2	6–8	3–4	Controlled
Walking lunge with DBs	2	6–8	3–4	Controlled
Romanian deadlift	5	5	2	3110
Leg curl (seated or lying)	4	6	2	3110
Barbell glute bridge or variation	4	6	2	3010
Calf raise	4	6	2	3110

WORKOUT **4**

Banded biceps curl	2	6–8	3–4	Controlled
Wide-grip vertical pulldown	2	6–8	3–4	Controlled
Barbell bent-over or Machine horizontal row	5	5	2	3110
Neutral-grip vertical pulldown	4	6	2	3110
Prone bench rear delt raise	4	6	2	3010
DB biceps curl or Machine biceps curl	4	6	2	3110

STRENGTH—5X PER WEEK

WORKOUT **1**

EXERCISE	SETS	REPS	RIR	TEMPO
Calf raise	2	6–8	3–4	Controlled
DB glute bridge	2	6–8	3–4	Controlled
Barbell back squat or Hack squat	5	5	2	3110
Leg press or Trap bar deadlift	4	6	2	3110
Leg extension	4	6	2	3010
Seated calf raise	4	6	2	3110

WORKOUT **2**

Machine horizontal row	2	6–8	3–4	Controlled
Machine shoulder press	2	6–8	3–4	Controlled
Barbell bench press or DB bench press	5	5	2	3110
Barbell overhead press or DB shoulder press	4	6	2	3110
Mid-cable chest fly or DB lateral raise	4	6	2	3010
Cross-cable triceps press-down or var.	4	6	2	3110

WORKOUT **3**

Calf raise	2	6–8	3–4	Controlled
Walking lunge with DBs	2	6–8	3–4	Controlled
Romanian deadlift	5	5	2	3110
Leg curl (seated or lying)	4	6	2	3110
Barbell glute bridge or variation	4	6	2	3010
Calf raise	4	6	2	3110

WORKOUT **4**

Banded biceps curl	2	6–8	3–4	Controlled
Wide-grip vertical pulldown	2	6–8	3–4	Controlled
Barbell bent-over row or variation	5	5	2	3110
Neutral-grip vertical pulldown	4	6	2	3110
Prone bench rear delt raise	4	6	2	3010
DB biceps curl or Machine biceps curl	4	6	2	3110

WORKOUT **5**

Machine horizontal row	2	6–8	3–4	Controlled
Machine shoulder press	2	6–8	3–4	Controlled
Incline DB bench press or Cable chest fly	4	6–8	2–3	3010
DB or Machine shoulder press	4	6–8	2–3	3010
DB lateral raise	4	6–8	2–3	3010
Rope triceps pushdown or variation	4	6–8	2–3	3010

STRENGTH ENDURANCE BEGINNER

Also known as muscular-endurance training, this training focusses on using low to moderate loads with shorter rest periods to challenge local muscular endurance.

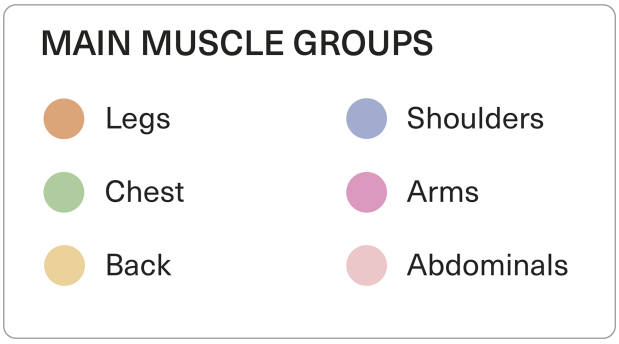
During these programmes you increase the total work capacity, or the total density of work per session. This style of training can also aid in the development of muscle and strength, and is effective when used in combination with other forms of training or sport. Exercise combinations – known as supersets or giant sets – will help challenge the body to sustain work capacity deeper into fatigue.

Begin each workout by warming up. Where indicated, you can choose a variation of the given exercise.

For all workouts

Any beginner's strength-endurance workout uses the following reps, sets, rest between sets, RIR, and tempo guidance, however often you're training:

12–15 REPS
3 SETS
(**4** SETS when training **4X** or **5X** a week)
45–60 SECONDS REST
3–4 RIR
CONTROLLED TEMPO



STRENGTH ENDURANCE—3X PER WEEK

WORKOUT **1**

EXERCISE
Leg press or DB squat
Leg curl (seated or lying)
DB bench press or Push-up
Wide-grip vertical pulldown or Pull-up
DB shoulder press or DB lateral raise
Alternating V-up crunch

WORKOUT **2**

Mid-cable chest fly or Push-up
Seated leg curl or variation
Neutral-grip horizontal row
Machine shoulder press or DB lateral raise
Leg extension or variation
Transverse abdominal ball crunch

WORKOUT **3**

Leg extension or variation
Neutral-grip vertical pulldown or Chin-up
DB bench press or Machine chest fly
Hamstring ball curl
Machine shoulder press or Front delt shoulder press
Bicycle crunch

STRENGTH ENDURANCE—4X PER WEEK

WORKOUT **1**

EXERCISE
Mid-cable chest fly or Push-up
Leg press or DB squat
Rope triceps pushdown or variation
DB shoulder press or DB lateral raise
Cable rope crunch

WORKOUT **2**

Neutral-grip vertical pulldown or Chin-up
Seated leg curl or variation
DB glute bridge or variation
DB biceps curl or variation
Calf raise

WORKOUT **3**

Leg extension or variation
DB bench press or Push-up
DB triceps extension or variation
Machine or DB shoulder press
Cable rotational oblique twist

WORKOUT **4**

Neutral-grip horizontal row
Seated leg curl or variation
DB glute bridge or variation
Banded biceps curl
Seated calf raise

STRENGTH ENDURANCE—5X PER WEEK

WORKOUT **1**

EXERCISE
Mid-cable chest fly or variation
Wide-grip vertical pulldown
DB rear delt fly or variation
DB biceps curl or variation
Cross-cable triceps pressdown or variation
Cable rope crunch or variation

WORKOUT **2**

Romanian deadlift or variation
Leg press
DB glute bridge or variation
Leg extension
Calf raise

WORKOUT **3**

DB shoulder press
DB lateral raise
Hammer curl
Cross-cable triceps pressdown
Cable rotational oblique twist
Decline ab crunch or Deadbug

WORKOUT **4**

Horizontal row or Barbell bent-over row
Wide-grip or Machine vertical pulldown
DB bench press or Push-up
DB bent-over row
Chest or back exercise of choice

WORKOUT **5**

Leg press or DB squat
Leg extension or variation
Leg curl (seated or lying)
DB glute bridge or variation
Machine rear delt fly
DB lateral raise or variation

STRENGTH ENDURANCE ADVANCED

These advanced strength-endurance programmes achieve progression mostly through increasing training volume and expanding exercise selection.

These programmes build on the beginner strength-endurance training by including a greater number and variety of exercises in each workout. The shorter rest periods used in these workouts, paired as in beginner-level programmes with low to moderate loads, further increase the density of work, training your muscles to last for longer under stress before you become fatigued.

For all workouts

Any advanced muscle-building workout uses the following rest between sets and RIR however often you're training:

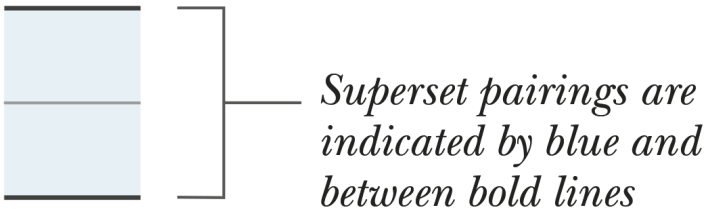
12–15 REPS

2–3 RIR

FOR GUIDANCE ON TEMPO AND GUIDANCE

Supersets

A superset is a combination of exercises performed one after another. For instance, in a chest press superset with a pulldown, you would perform the chest press reps, rest for the prescribed time, then perform the pulldown reps. This example is an agonist–antagonist superset: it trains opposing muscle groups, saving you time without impacting performance. Other pairings include exercises that work the same body part, upper body–lower body, and agonist–synergist. You do not have to do supersets, but doing so is an effective way to work out.



Double-tap image to read the labels

MAIN MUSCLE GROUPS

- Legs
- Shoulders
- Chest
- Arms
- Back
- Abdominals

STRENGTH ENDURANCE—3X PER WEEK

WORKOUT **1**

EXERCISE	SETS	REST	TEMPO
Hack squat or Leg press	4	45s	Controlled
Leg curl (seated or lying)	4	45s	Controlled
DB bench press or Mid-cable chest fly	4	45s	Controlled
Vertical pulldown or Pull-up	4	45s	Controlled
DB shoulder press or DB lateral raise	4	45s	Controlled
Cable rope crunch	4	45s	Controlled

WORKOUT **2**

Mid-cable chest fly or Push-up	4	45s	Controlled
Leg curl or variation	4	45s	Controlled
Neutral-grip horizontal row	4	45s	Controlled
Machine shoulder press or DB lateral raise	4	45s	Controlled
Leg extension or variation	4	45s	Controlled
TVA ball crunch	4	45s	Controlled

WORKOUT **3**

Leg extension or variation	4	45s	Controlled
Machine vertical pulldown or Chin-up	4	45s	Controlled
DB bench press or Machine chest fly	4	45s	Controlled
Seated leg curl	4	45s	Controlled
Machine shoulder press or Front delt shoulder press	4	45s	Controlled
Cable rotational oblique twist	4	45s	Controlled

STRENGTH ENDURANCE—4X PER WEEK

WORKOUT **1**

EXERCISE	SETS	REST	TEMPO
Mid-cable or Machine chest fly	3	30s	3010
Leg press or DB squat	3	45–60s	3010
DB bench press or Push-up	3	30s	3010
Leg extension	3	45–60s	3010
Rope triceps pushdown or variation	3	30s	3010
DB shoulder press	3	45–60s	3010
DB triceps extension	3	30s	3010
DB lateral raise	3	45–60s	3010
Cable rope crunch	4	30–45s	Controlled

WORKOUT **2**

Neutral-grip vertical pulldown or Chin-up	3	30s	3010
Seated leg curl or variation	3	45–60s	3010
Neutral-grip horizontal row	3	30s	3010
Romanian deadlift	3	45–60s	3010
DB glute bridge or variation	3	30s	3010
DB biceps curl or Banded biceps curl	3	45–60s	3010
Standing cable glute kickback	3	30s	3010
Hammer curl	3	45–60s	3010
Calf raise	4	30–45s	Controlled

WORKOUT **3**

Leg extension or variation	3	30s	3010
DB bench press or Push-up	3	45–60s	3010
DB goblet squat or Stationary lunge with DBs	3	30s	3010
Mid-cable chest fly or variation	3	45–60s	3010
DB triceps extension or variation	3	30s	3010
Machine shoulder press or DB shoulder press	3	45–60s	3010
Cross-cable triceps pressdown	3	30s	3010
DB lateral raise or variation	3	45–60s	3010
Side plank with rotation	4	30–45s	Controlled

WORKOUT **4**

Neutral-grip horizontal row	3	30s	3010
Romanian deadlift	3	45–60s	3010
Wide-grip vertical pulldown or Pull-up	3	30s	3010
Seated leg curl or variation	3	45–60s	3010
Standing cable glute kickback	3	30s	3010
Hammer curl	3	45–60s	3010
DB glute bridge or variation	3	30s	3010
DB biceps curl or Banded biceps curl	3	45–60s	3010
Seated calf raise	4	30–45s	Controlled

STRENGTH ENDURANCE—5X PER WEEK

WORKOUT **1**

EXERCISE	SETS	REST	TEMPO
Mid-cable chest fly or variation	3	30s	3010
Wide-grip vertical pulldown	3	45–60s	3010
DB bench press or variation	3	30s	3010
DB bent-over row or variation	3	45–60s	3010
Machine rear delt fly or variation	4	30s	3010
DB biceps curl or variation	4	45–60s	3010
Cross-cable triceps pressdown	4	30s	3010
Cable rope crunch or variation	4	45–60s	3010

WORKOUT **2**

Romanian deadlift	3	30s	3010
Leg press	3	45–60s	3010
Leg curl or variation	3	30s	3010
Leg extension or variation	3	45–60s	3010
DB glute bridge or variation	3	30s	3010
Back foot elevated split squat	3	45–60s	3010
Calf raise	4	30–45s	Controlled

WORKOUT **3**

DB shoulder press or variation	3	30s	3010
DB lateral raise	3	45–60s	3010
Hammer curl	3	30s	3010
Cross-cable triceps pressdown	3	45–60s	3010
Cable upright row	3	30s	3010
Decline ab crunch	3	45–60s	3010
Cable or Banded front raise	3	30s	3010
Cable rotational oblique twist or variation	3	45–60s	3010

WORKOUT **4**

Barbell bent-over row	3	30s	3010
Machine vertical pulldown	3	45–60s	3010
DB bench press or Push-up	3	30s	3010
Neutral-grip horizontal row	3	45–60s	3010
High–low cable chest fly or variation	3	30s	3010
Dumbbell bent-over row	3	45–60s	3010
Chest or back variation of choice	4	30–45s	Controlled

WORKOUT **5**

Leg press	3	30s	3010
Walking lunge with DBs	3	45–60s	3010
Leg curl	3	30s	3010
DB glute bridge or variation	3	45–60s	3010
Prone bench rear delt raise	3	30s	3010
DB lateral raise or variation	3	45–60s	3010
TVA ball crunch	3	30s	3010
Cable rope crunch	3	45–60s	3010

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GLOSSARY

1 rep maximum (1RM) The maximum amount of weight a person can lift during one repetition of an exercise; training intensity is measured by expressing the load used as a percentage of this amount.

Abdominals (abs) A group of muscles in the torso consisting of the rectus abdominis, the external abdominal obliques, the internal abdominal obliques, and the transverse abdominis.

Abduction The action of moving a limb away from the midline of the body.

Actin A protein that interacts with myosin to cause muscle contraction.

Adduction The action of moving a limb toward the midline of the body.

Adductors A group of muscles that are used to draw the thighs toward the midline, consisting of the adductor longus, the adductor brevis, the adductor magnus, the pectineus, and the gracilis.

Agonist A muscle that, opposing another muscle, causes a movement to happen.

Amino acids Organic compounds that combine to form proteins; they are necessary for a number of processes in the body.

Antagonist A muscle that acts as the opposing force in muscle contraction or relaxation.

Anterior Positioned at the front.

ATP Adenosine triphosphate; a molecule that is the energy currency of a cell.

Barbell A piece of exercise equipment consisting of a long bar with weights at either end.

Bilateral On both sides of the body simultaneously.

Cable pulley An exercise machine consisting of an adjustable pulley system and a cable with a handle.

Carbohydrates Naturally occurring chemical substances that contain carbon, hydrogen, and oxygen; they are the primary source of energy when stored in the body.

Cluster set A set that is broken up into subsets with additional short rest periods in between them; the reps within a cluster set can be performed at greater intensity thanks to the additional rest intervals.

Coactivation When multiple muscles activate simultaneously.

Concentric contraction Muscle shortening in response to a load, as in lifting a weight in a biceps curl.

Deadlift An exercise that involves extending at the knees and/or hips to lift a weight from the ground.

Deep (of muscles) Further in from the skin.

Deltoid (delts) A muscle of the shoulder.

Dropsets Sets performed consecutively with incremental reductions in load.

Dumbbell A type of exercise equipment consisting of a short bar with weights at either end; usually used in a pair.

Eccentric contraction Muscle lengthening in response to a load, as in lowering a weight in a biceps curl.

Elbow flexors A group of muscles that are used to flex the arm at the elbow, consisting of the biceps brachii, the brachialis, and the brachioradialis.

Extension A movement that increases the angle of a joint.

EZ bar A type of barbell with a waved bar.

Fascicle A bundle of muscle fibres.

Fat A nutrient with several necessary functions in the body, including protecting internal organs and nerves and assisting the absorption of vitamins.

Fatigue management The process of keeping track of and adjusting the amount of fatigue experienced during training.

Flexion A movement that decreases the angle of a joint.

Form The manner in which an exercise is performed; good form maximizes the safety and benefits of the exercise.

Glucose A simple sugar that is the body's preferred energy source.

Glutes A group of muscles in the buttocks consisting of the gluteus maximus, the gluteus medius, and the gluteus minimus.

Glycogen A carbohydrate formed of connected glucose molecules, used by the body to store glucose primarily in skeletal muscles and the liver.

Hip extensors A group of muscles that are used to extend the hips and draw the thighs back, consisting of the glutes, the adductor magnus, and the hamstrings (the biceps femoris, the semitendinosus, and the semimembranosus).

Hypertrophy Muscle growth due to increase in the size of cells.

Isometric contraction When a muscle is activated, but instead of lengthening or shortening, it is held at a constant length.

Isotonic contraction Muscle engagement where the muscle changes length; can be either eccentric or concentric.

Lateral Positioned at the side(s).

Latissimus dorsi (lats) A muscle of the back.

Load The amount of weight used in an exercise.

Metabolic stress The accumulation of metabolites (such as lactate) in muscles due to exercise.

Muscle building Training to promote muscle growth.

Myosin A protein that interacts with actin to cause muscle contraction.

Neutral grip A way of holding a weight, cable, etc., where the wrists are not rotated, so the palms face each other.

Neutral spine Position of optimal load distribution for the spine; maintains the natural curves of the spine.

Pectorals (pecs) A group of muscles in the chest consisting of the pectoralis major and the pectoralis minor.

Posterior Positioned at the back.

Pronated grip A way of holding a weight, cable, etc., where the wrists are rotated so the palms face downward or away from you.

Prone Lying on your front.

Protein A molecule made up of amino acids; dietary protein is necessary for life and bodily maintenance.

Quadriceps (quads) A group of muscles in the thigh consisting of the rectus femoris, the vastus medialis, the vastus lateralis, and the vastus intermedius.

Range of motion The extent of possible movement of a joint.

Repetition (rep) An instance of performing the complete motion of an exercise.

Resistance An external force against which muscles contract, such as weight.

Rhomboids A group of muscles in the upper back consisting of the rhomboid minor and the rhomboid major.

RIR Reps in reserve; a measure of the difficulty of a set that refers to the number of further reps that the person could have performed before giving way to fatigue.

Sarcomere The basic functional unit of contraction of a muscle fibre.

Semi-supinated grip A way of holding a weight, cable, etc., where the wrists are partly rotated so the palms face diagonally upward and inward; halfway between a neutral and a supinated grip.

Set A combined group of consecutive repetitions of an exercise performed for a desired or prescribed number of repetitions.

Skeletal muscle Striated muscle tissue connected to the skeletal system that allows for movement.

Strength The amount of force a muscle or muscle group can produce.

Strength endurance Also known as muscular endurance; the ability of muscles to support load continuously over time.

Stress Mechanical, metabolic, or psychological demands placed on the body.

Superficial (of muscles) Closer to the skin.

Superset A combination of sets of different exercises performed sequentially.

Supinated grip A way of holding a weight, cable, etc., where the wrists are rotated so the palms face upward or toward you.

Supine Lying on your back.

Synergist A muscle that acts around a joint to support the action of an agonist muscle.

Tempo The rhythm with which exercises are performed during sets.

Tendon A fibrous cord made up of collagen that attaches muscle to bone.

Training intensity The amount of load used during an exercise, normally expressed as a percentage of 1 rep maximum.

Training volume The amount of exercise or work performed over a given period of time.

Trapezius A muscle of the upper back.

Unilateral On one side of the body.

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