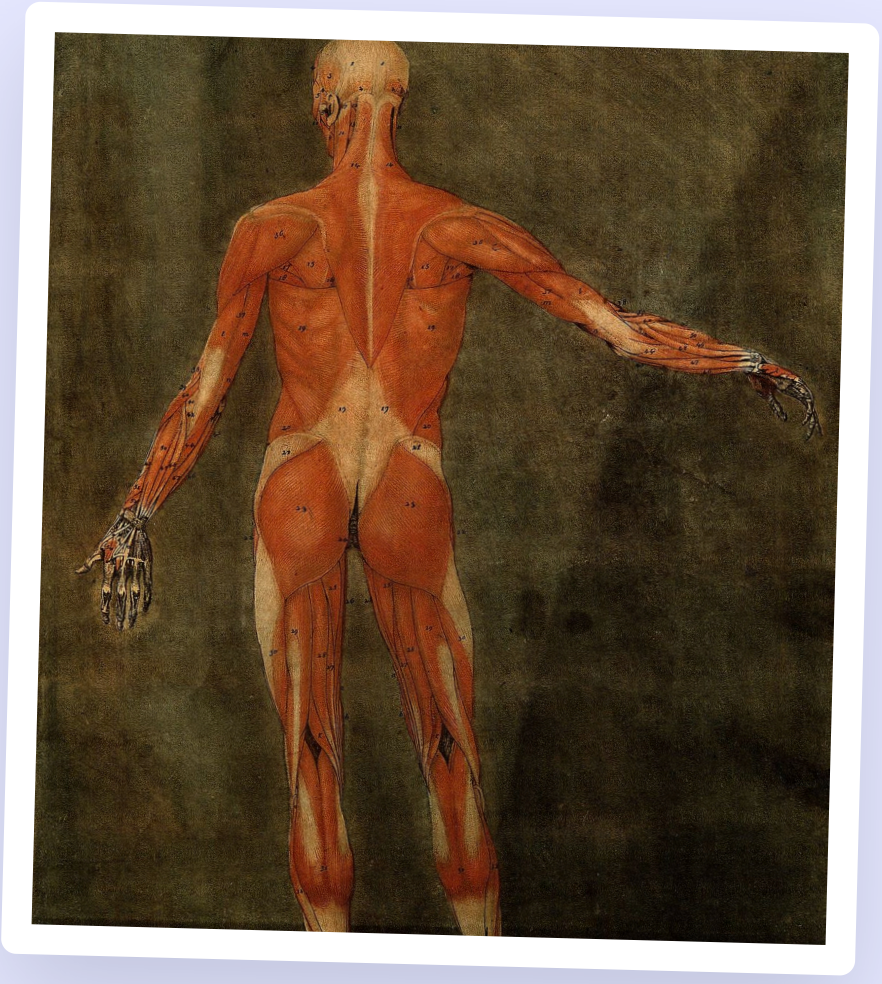
FREE · NOVEMBER 2026 EDITION

# The Glute Training Magazine

More than 200 years of glute science, from the first anatomists to the first MRI scans. Every claim referenced, every researcher credited.



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Each chapter also has a short animated film and an interactive version at bootycenter.com/magazine. Spotted an error? Email academy@bootycenter.com.

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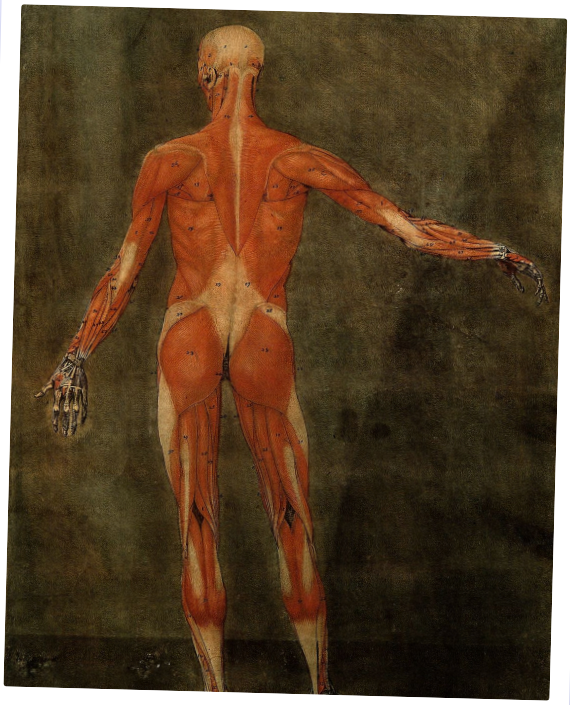
CHAPTER 1 · 1800 TO 1895

# The Anatomists

No gyms. No glute workouts. Just scalpels, electric current and patients. And one question: what is the big human glute actually for?

Booty Center · 9 minute read · 6 sources

▶ Watch the film | Play the interactive



The muscles of the back, a colour print from 1773. Anatomists could draw every muscle. They could not yet see one work.

Look at the picture above. It was printed in 1773, copied from the work of the Dutch anatomist Bernhard Siegfried Albinus. Every muscle of the back is there, down to the last fibre. The buttocks are drawn as two great rounded masses, bigger than almost anything else on the body.

By then, anatomists had cut open bodies for more than two hundred years. They knew the shape of the glutes, where they start on the pelvis and where they end on the thigh. What they did not know was what the muscle does in a living person, and when. A dead body shows you the shape. It does not show you the job.

This chapter is about three men who tried to answer that question in the 1800s. One used logic. One used electricity. One used a sick child's walk. Between them, they set up a debate that took another hundred years to settle.

PART 1 · THE IDEA

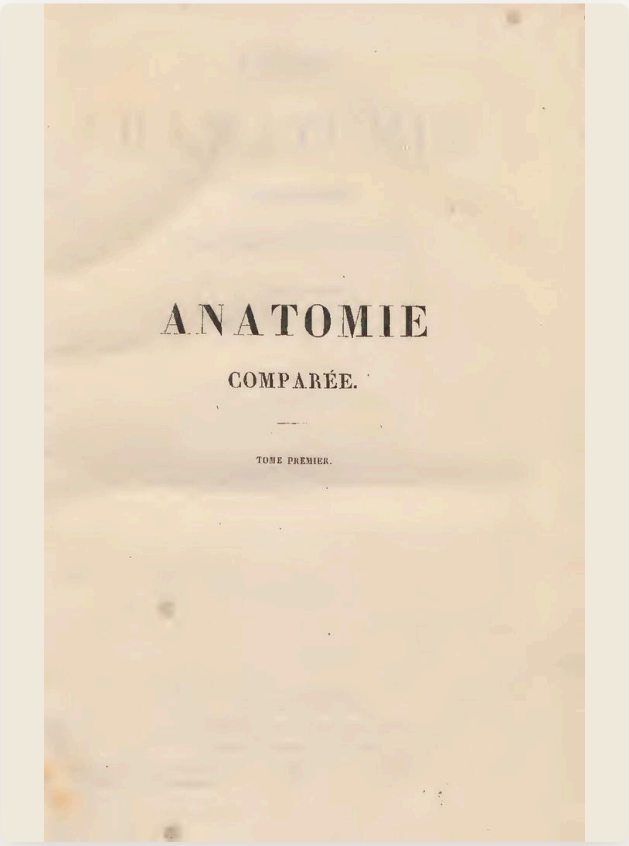
## "The only animal with true buttocks"

| WHO | LIVED | WHERE | KNOWN FOR |
|---|---|---|---|
| Georges Cuvier | 1769 to 1832 | Natural history museum, Paris | Founding comparative anatomy |




**Georges Cuvier**, with a fossil fish on the table. He showed that animals can go extinct.

Wellcome Collection, CC BY 4.0




**Lessons in Comparative Anatomy**, volume 1. The glute line is in Lesson 7, on standing.

Public domain

Georges Cuvier was one of the most famous scientists in France. He compared the skeletons and muscles of hundreds of animals, living and fossil, and he proved that whole species had died out. His lectures on comparative anatomy were printed in Paris from 1800. A second edition came out in 1835, after his death, and that is the edition most modern papers cite.

In the lesson on standing, Cuvier asked a simple question. How does a human stay upright on two legs, when every other mammal uses four? He went through the body joint by joint. At the ankle, he said, the weight of the body wants to tip the leg forward, so the calf muscles must hold it back. That is why only humans have real calves.

Then he came to the hip. Here the weight of the trunk wants to fold the body forward over the thighs. So the muscles that pull the hip straight must be strong. And one of them most of all.

## "That is why the extensors of the hip, and above all the gluteus maximus, are so large in man, who is the only animal with true buttocks, just as he is the only one with true calves."

*« C'est pour cela que ses extenseurs, et surtout le grand fessier, sont si considérables dans l'homme, qui est le seul animal qui ait de véritables fesses, comme il est le seul qui ait de vrais mollets. »*

**Georges Cuvier, Lessons in Comparative Anatomy, Lesson 7. Our translation.**

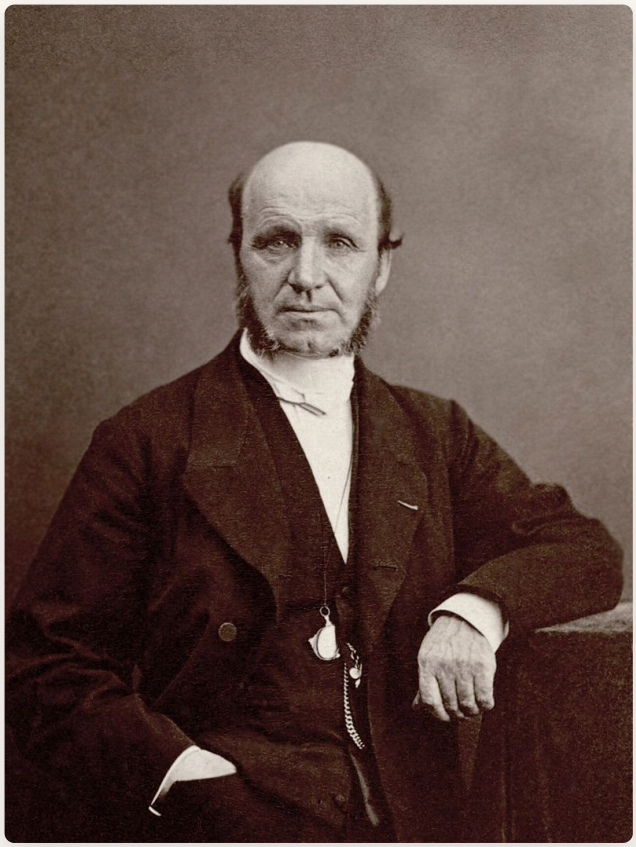
It was a beautiful argument. Humans stand upright. Humans have the biggest glutes. So the glutes must be what holds us upright. It sounded so obvious that almost nobody checked it.

The problem is that Cuvier never watched the muscle work. Nobody could, yet. He was reasoning from shape, the same way you might guess what a tool does from how it looks. The guess turned out to be wrong, and it took a doctor with a box of batteries to show it.

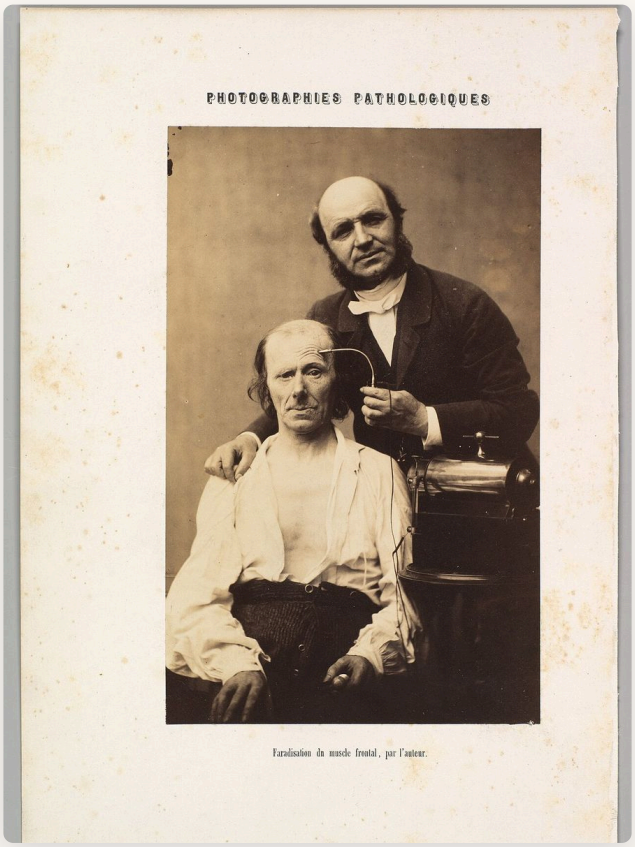
PART 2 · THE TEST

# The doctor with the electrodes

| WHO | LIVED | WHERE | KNOWN FOR |
|---|---|---|---|
| Guillaume Duchenne | 1806 to 1875 | Hospitals of Paris | Mapping muscles with electricity |



**Guillaume Duchenne**, photographed by Nadar, the most famous portrait photographer in Paris.
Bibliothèque nationale de France, public domain



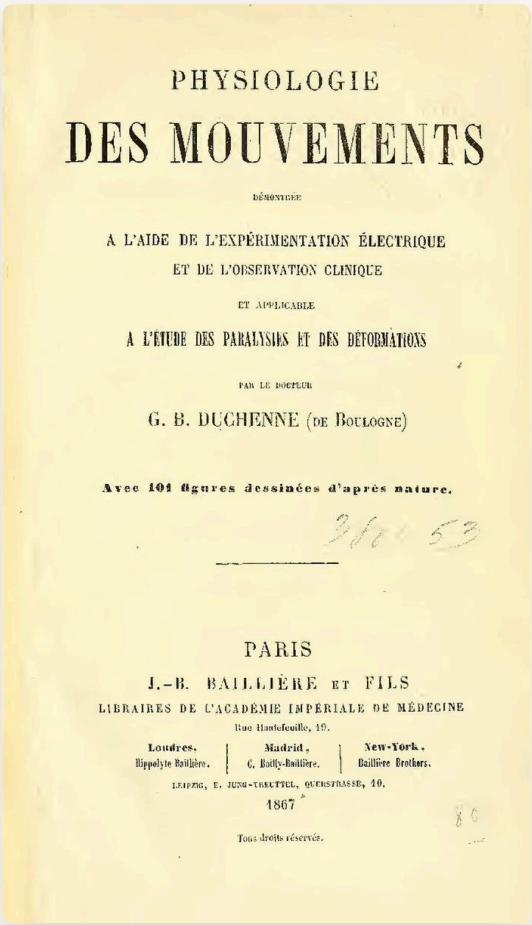

**The method.** Duchenne holds two electrodes to a man's forehead to make one muscle contract. Photographed 1854 to 1856.
The Metropolitan Museum of Art, CC0

Guillaume Duchenne came from Boulogne, a fishing town on the north coast of France. When he moved to Paris, he added "de Boulogne" to his name, so people would not confuse him with another doctor there. He spent most of his career walking from hospital to hospital, carrying an electrical machine.

His idea was clever. Put two wet electrodes on the skin, right over one muscle, and send a small current through. That one muscle contracts, and nothing else does. Now you can see exactly what it does on its own. He did this for the face first. His

1862 book of photographs showed people smiling, frowning and crying, all made by electricity. Today the real, eye-crinkling smile is still called the Duchenne smile.

Then he turned to the rest of the body. He had a second, even better tool: patients. In the wards of Paris there were people who had lost the use of one muscle, through nerve injury or disease. Each one was a natural experiment. If a person has no working glute max, what can they still do?



PHYSIOLOGIE

DES MOUVEMENTS

DÉMONTRÉE

A L'AIDE DE L'EXPÉRIMENTATION ÉLECTRIQUE

ET DE L'OBSERVATION CLINIQUE

ET APPLICABLE

A L'ÉTUDE DES PARALYSIES ET DES DÉFORMATIONS

PAR LE DOCTEUR

G. B. DUCHENNE (DE BOULOGNE)

Avec 101 figures dessinées d'après nature.

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1867

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**Physiology of Movement**, 1867. Almost 900 pages on what each muscle does, tested with current and with patients.

Public domain. Scan from the Internet Archive

The answer, published in 1867, surprised him. When he sent current into the glute max, it pulled the thigh back very hard and turned it outward. A powerful muscle. But when he watched patients whose glute max was paralysed, they stood normally. They walked on flat ground normally. In quiet standing and in ordinary walking, he concluded, the muscle was doing nothing at all.

So where did they struggle? Duchenne made a list.

**Without a working glute max, his patients could still**

- Stand
- Walk on flat ground

**But they struggled to**

- Climb stairs
- Walk uphill
- Rise from a seat
- Jump
- Dance
- Carry a heavy load on the shoulders

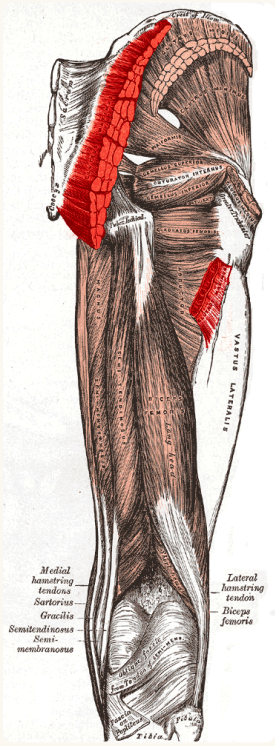
Duchenne's list, from Physiology of Movement, 1867. Drawn by Booty Center.

Read that list again. Every item is a big effort: lifting the body up a step or a slope, driving it off the ground, or bracing under a load. Standing still was not on it. For holding the body upright, Duchenne gave more credit to the hamstrings at the back of the thigh than to the glute max.

In other words, Cuvier's idea had already failed its first real test. The biggest muscle in the hip was not a posture muscle. It was a power muscle, saved for the hard jobs.

## Where the muscles sit

The glute max is the big outer muscle, highlighted in red. It runs from the back of the pelvis and the base of the spine down to the back of the thigh bone. Under it and to the side sit two smaller glutes, the medius and the minimus. Those two are the stars of the next part of the story.




Gray's Anatomy, 1918, with the glute max highlighted. Public domain.

Duchenne also mapped those side glutes. The gluteus medius, he found, works in two halves. The front half turns the thigh inward. The back half turns it outward. And he saw what happens when it is weak: stand the patient on that leg, and the pelvis drops on the other side. He described it in 1867. A surgeon in Germany would make it famous almost thirty years later.

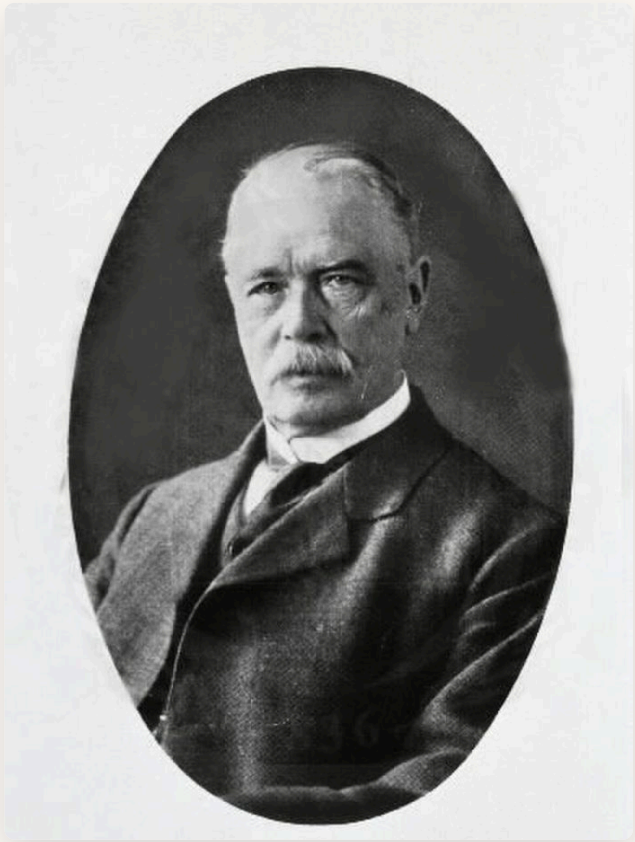
**SAME MAN, OTHER FAME**

A muscle disease that mostly affects boys, **Duchenne muscular dystrophy**, is named after him. He described it in the 1860s, in the same years he was studying the glutes.

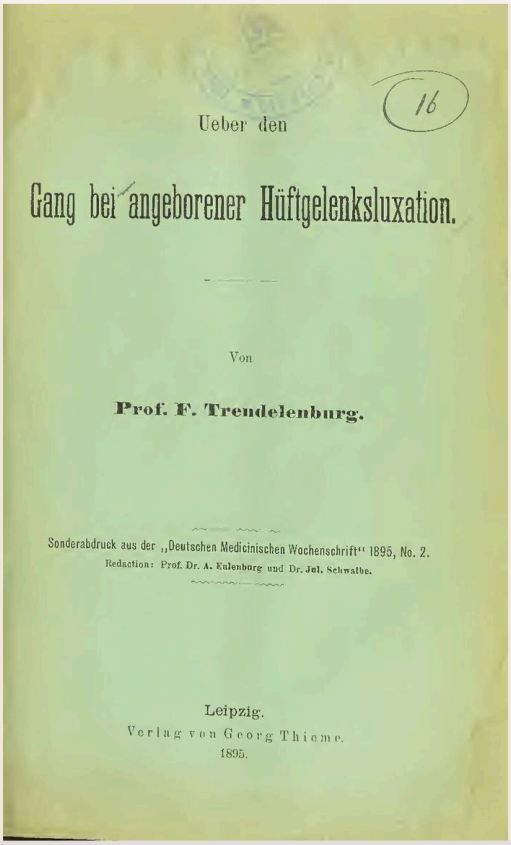
PART 3 · THE SIGN

# The waddle and the one-leg test

| WHO | LIVED | WHERE | KNOWN FOR |
|---|---|---|---|
| Friedrich Trendelenburg | 1844 to 1924 | University surgical clinic, Bonn | Surgery, and a test still used today |



**Friedrich Trendelenburg**, around 1910.
Public domain

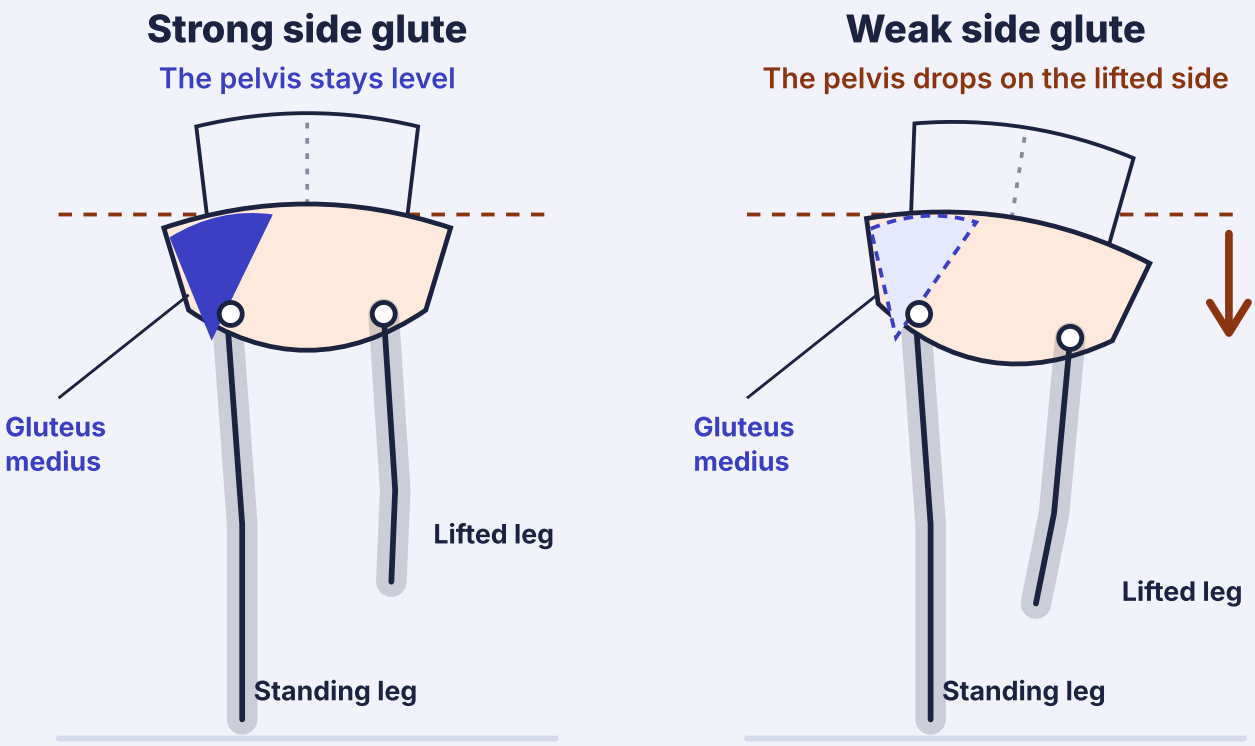



**On the Gait in Congenital Hip Dislocation**, his 1895 paper, as a printed offprint.
Royal College of Surgeons of England, public domain

Friedrich Trendelenburg was a surgeon, and a very good one. Surgeons still tilt patients head-down on the operating table in the Trendelenburg position. But in 1895, at the surgical clinic in Bonn, he was puzzling over a walk.

Some children are born with a hip joint that is out of place. These children walked with a rolling waddle, swaying from side to side. Many doctors put the waddle down to the loose joint itself, the thigh bone sliding up and down. Trendelenburg looked closer. He traced it to the side glutes of the standing leg, the medius and the minimus. With the hip out of place, they could not do their job, which is to hold the pelvis level when you stand on one leg.

Think about walking. With every step, for a moment, all your weight is on one leg. In that moment, the side glutes of that leg hold the pelvis from the side and stop the other side from dropping. If they cannot, the pelvis tips, and the body sways to make up for it. Step after step, that becomes a waddle.




The one-leg test, seen from behind. Stand on one leg. If the side glute of the standing leg is strong, the pelvis stays level. If it is weak, the pelvis drops on the lifted side. Drawn by Booty Center.

His check was so simple that anyone can do it. Ask the person to stand on one leg, and watch the pelvis from behind. Level is good. Dropping on the lifted side means the side glutes of the standing leg are not coping. Clinics around the world still use it, and it still carries his name: the Trendelenburg test.

His paper was written in German. An English translation was published in 1998. You can find both in the sources below.

PART 4 · THE SCORECARD

## A century in six dates

**1773**
A colour print shows the muscles of the back, after the anatomist Albinus.

**1800**
Cuvier's lectures on comparative anatomy are first printed in Paris.

**1835** IDEA
A new edition appears after his death. Modern papers cite this one.

**1862**
Duchenne publishes his photographs of faces moved by electric current.

**1867** TEST
Duchenne's *Physiologie des mouvements*. The glute max rests in standing and walking.

**1895** SIGN
Trendelenburg explains the waddle. The one-leg test is born.

So by 1895 there were three answers on the table. An idea, that the big glute holds us upright. A test, showing it rests during standing and walking and works hard when the body has to climb, rise or jump. And a clinic sign, showing that weak

side glutes let the pelvis drop.

Only one of these was a guess. The other two came from watching living people. That difference is the whole story of glute science in one line, and you will see it again in every chapter of this magazine.

THE OLD BELIEF THIS CHAPTER TESTS

## "The big glute is there to hold us upright."

**Not supported**

Duchenne's patients stood and walked on flat ground without it in 1867. Yet the upright idea stayed in textbooks for about another hundred years, until scientists could record the muscle directly. That is Chapter 2.

WHAT THIS MEANS FOR TRAINING TODAY

Your glute max does little while you stand or stroll. It works hardest when your hips must drive the body up or forward against resistance: climbing, rising, jumping, lifting. That is why glute training is built on hip extension against real load. And your side glutes are what keep the pelvis level on one leg, a job they do in every step you take. Later chapters show the modern evidence for both.




## Watch Chapter 1

The same story as a short animated film with voiceover, 2 minutes 44 seconds. Or play the interactive version and make your guess before the answer.

**Play the interactive**

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## Image credits

- **Opening image.** Arnauld-Éloi Gautier d'Agoty, *The muscles of the human body, first layer, seen from the back*, colour mezzotint, 1773, after Bernhard Siegfried Albinus. Wellcome Collection, CC BY 4.0. Source
- **Cuvier.** Portrait of Baron Georges Cuvier, engraving. Wellcome Collection, CC BY 4.0. Source
- **Cuvier's lectures.** Title page, *Leçons d'anatomie comparée*, tome 1. Public domain. Source
- **Duchenne.** Portrait by Nadar. Bibliothèque nationale de France. Public domain. Source
- **Electrodes.** Duchenne de Boulogne and Adrien Tournachon, *Faradisation du muscle frontal*, 1854 to 1856, printed 1862. The Metropolitan Museum of Art, CC0. Source
- **Duchenne's book.** Title page, *Physiologie des mouvements*, 1867. Public domain. Source
- **Trendelenburg.** Portrait, about 1910. Public domain. Source
- **Trendelenburg's paper.** Title page of the 1895 offprint. Royal College of Surgeons of England. Public domain. Source
- **Muscle map.** Henry Gray, *Anatomy of the Human Body*, 1918, figure 434, highlight by Mikael Häggström. Public domain. Source
- **Drawings.** One-leg test and Duchenne's list drawn by Booty Center for this magazine.

## How to cite this chapter

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CHAPTER 2 · 1791 TO 1989

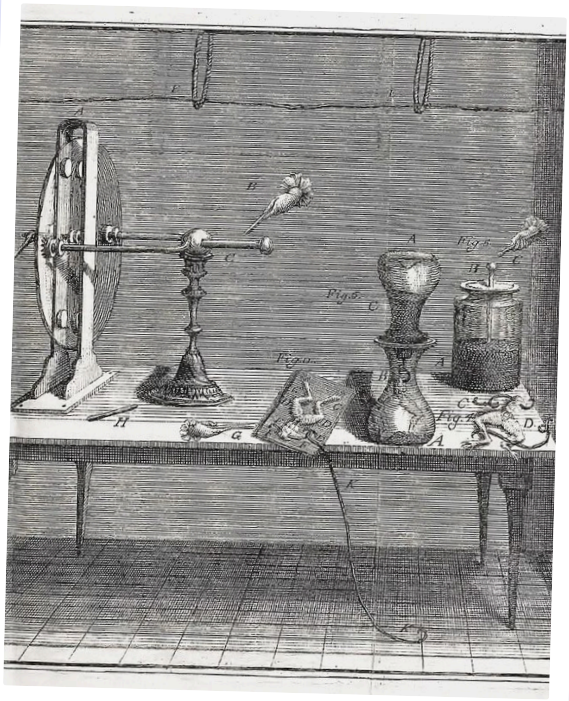
# Wires on the Muscle

Put a wire on a working muscle and you can hear it. When scientists finally listened to the glutes, the biggest one was almost silent.

Booty Center · 6 minute read · 10 sources

▶ Watch the film

Play the interactive



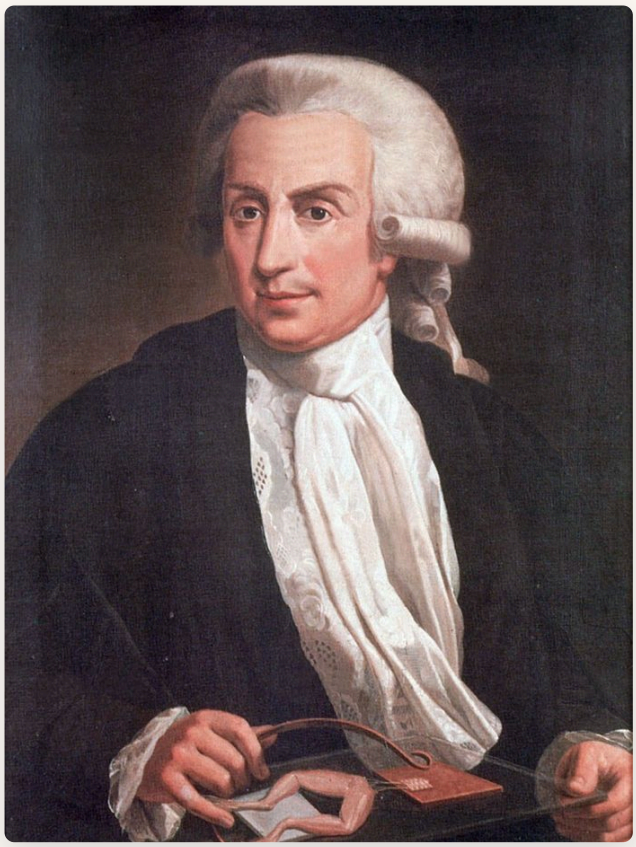
Galvani's lab, 1791. Frog legs, metal and sparks: the first clue that muscles run on electricity.

Chapter 1 ended with a problem. Duchenne could make a muscle twitch with current, and he could watch what patients did without it. But nobody could watch a healthy glute at work, from the inside, while a person stood, walked or climbed. That needed a way to listen to the muscle itself.

The tool that finally did it is called electromyography, or EMG. This chapter tells how it was born, and what happened when scientists in the 1950s to 1980s pointed it at the hip. The short version: the glute was quieter than anyone expected, and it was not one single block.

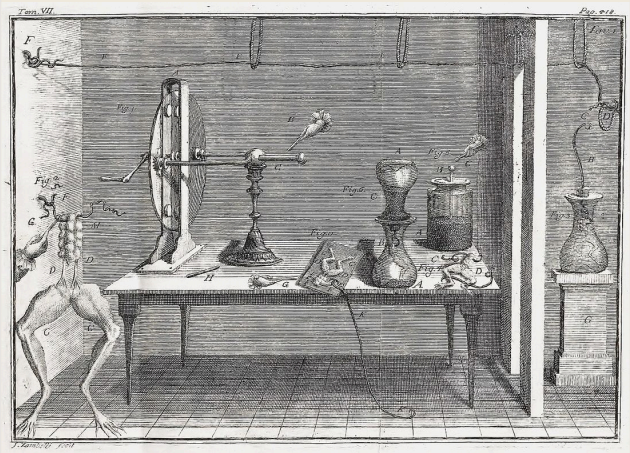
PART 1 · THE SPARK

# Frogs, metal and a twitching arm



**Luigi Galvani**, anatomist in Bologna, painted with his frog legs.

Public domain

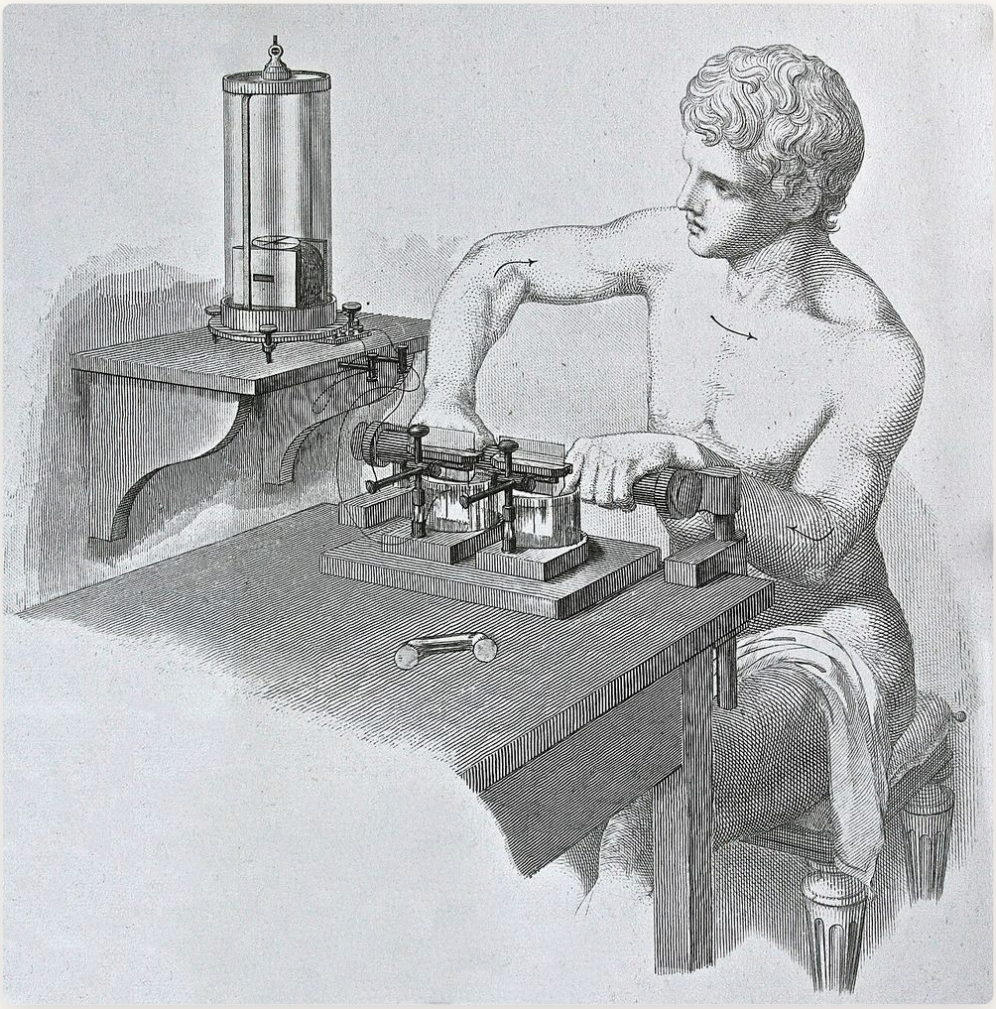


**His lab, 1791.** A plate from his book on electricity and muscle movement.

Public domain

The story starts with frogs. In 1791 the Italian anatomist Luigi Galvani published a book about something strange he saw in his lab in Bologna. Frog legs, prepared for dissection, kicked when they were touched with metal or when an electrical machine sparked nearby. Galvani was convinced that the animal itself made electricity, and that this electricity was what moved the muscles.

He was not fully right about how it worked, and the argument that followed with the physicist Alessandro Volta led to the first battery. But the big idea held: muscles and nerves run on electricity.



**A muscle you can measure.** Emil du Bois-Reymond's own experiment. His fingers sit in vessels wired to a sensitive meter. When he tightened one arm, the needle moved.

From Untersuchungen über thierische Elektricität, volume 2. Scan via Wikimedia Commons, CC BY-SA 4.0

The next step came in Berlin in the 1840s. The physiologist Emil du Bois-Reymond sat at a table, dipped his fingers into two small vessels wired to a very sensitive meter, and tightened the muscles of one arm. The needle moved. A living person's working muscle was giving off a current you could measure.

It was a beautiful proof, but it was crude. A needle swinging on a dial cannot tell you which muscle is working, or how hard, or when. That took another century of better amplifiers, screens and electrodes. By the 1950s, labs could finally record a single muscle in a moving person.

**HOW EMG WORKS, IN ONE LINE**

Every time a muscle fibre contracts, it gives off a tiny electrical signal. An **electrode** on the skin, or a fine wire placed in the muscle, picks it up. A quiet line means the muscle is resting. A busy line means it is working.

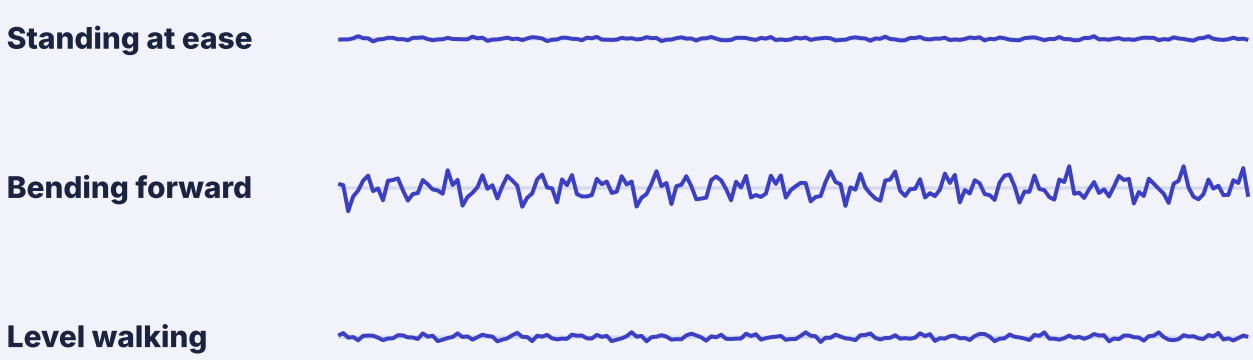
PART 2 · THE SURPRISE

# The quiet giant

One of the first EMG studies of the hip and thigh muscles in healthy people came out in 1951, from Wheatley and Jahnke. The glutes were now on the record. But the study that really changed the story came six years later.

In 1957, Joseph and Williams placed electrodes on the glute max and asked people to simply stand at ease. If Cuvier was right, and the big glute is what holds us upright, the line should have been busy.

It was almost flat. In relaxed standing, the glute max barely fired at all. They concluded it was not an important posture muscle. It showed moderate activity when people bent forward. Other studies found the same quiet line in ordinary level walking.




What the early recordings showed for the glute max, as later reviews describe them. Drawn by Booty Center as an illustration, not the original traces.

Think about what that means. One of the biggest muscles in the human body was mostly switched off during the two things we do most: standing and walking. Duchenne had already hinted at this in 1867 by watching his patients. Now the wires showed it directly.

PART 3 · MAPPING THE MUSCLE

# What makes the glute max fire?

If the glute max is not for standing, what is it for? Through the 1960s, researchers started testing movement after movement to find out.

In 1965, Karlsson and Jonsson mapped what the muscle does. It worked when the hip extended, when the thigh turned outward, and when the leg was lifted out to the side. Later papers cite their study as the first to link the upper part of the glute max to that sideways lift.

In 1968, Fischer and Houtz asked a sharper question: what fires the glute max hardest? Their list, as a later review reports it, was squeezing the muscle hard, turning the thigh outward, lifting the leg sideways against resistance, and driving the thigh and trunk hard into extension while standing.

**What fired the glute max hardest, Fischer and Houtz, 1968**

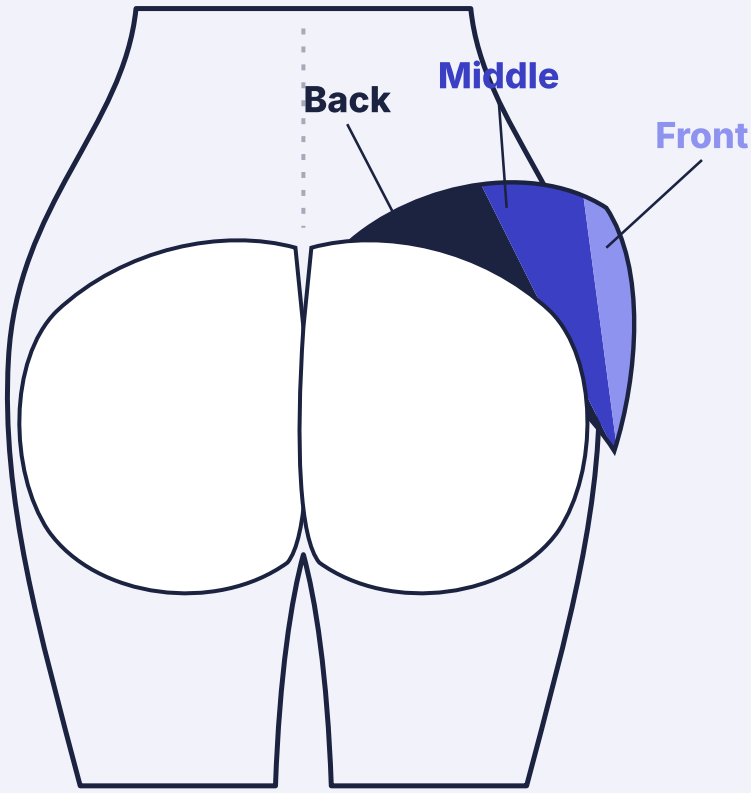
- Squeezing the muscle hard
- Turning the thigh outward
- Lifting the leg sideways against resistance
- Hard extension of the thigh and trunk, standing

Notice the pattern. Again, every item on the list is effort. Nothing on it is quiet standing.

PART 4 · NOT ONE BLOCK

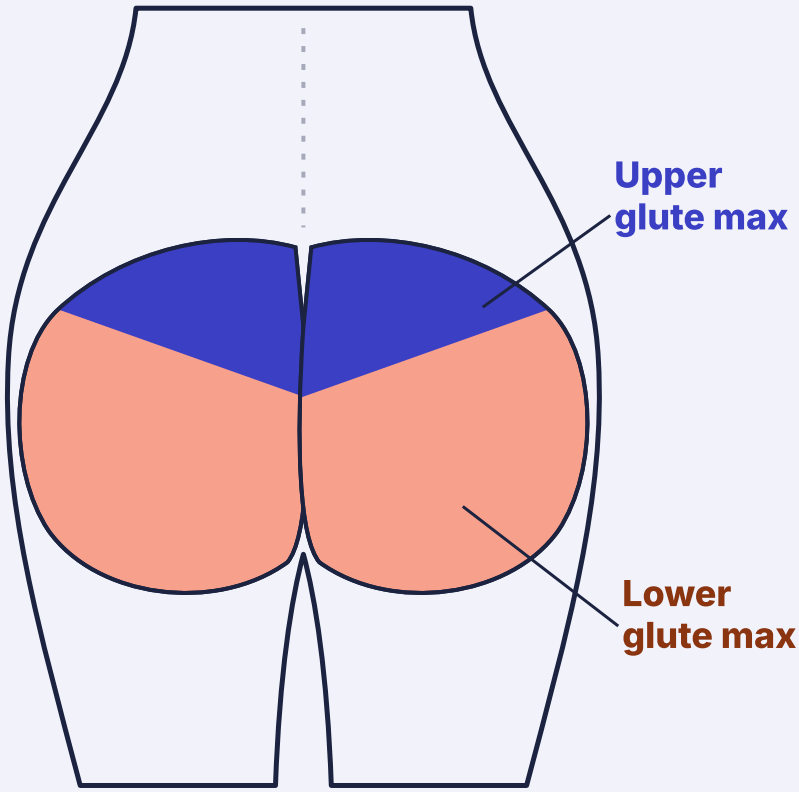
# Upper, lower, front, middle, back

The next discovery changed how we talk about glutes to this day. Bit by bit, the wires showed that these muscles are not single blocks. Different parts of the same muscle can do different jobs.




The side glute, gluteus medius, fans out from the top of the pelvis to the thigh bone. Soderberg and Dostal recorded its back, middle and front parts separately. Schematic drawn by Booty Center.

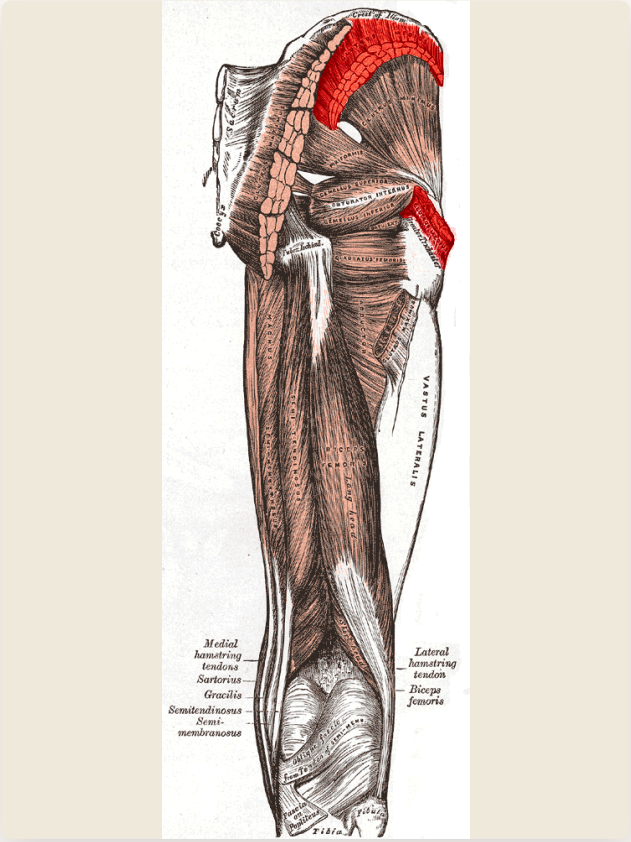
In 1978, Gary Soderberg and Dostal turned to the side glute, the gluteus medius. They placed a fine wire electrode in the front, the middle and the back of the muscle in ten people. In some tasks, the three parts fired at different times. One muscle, three working parts.




The glute max seen from behind, split into its upper and lower parts. Lyons, Perry and colleagues found the two parts behave differently. Schematic drawn by Booty Center.

In 1983, a team in California led by Lyons, with the famous gait researcher Jacquelin Perry, recorded eleven healthy people walking and climbing stairs. They found the upper glute max behaved more like the side glute, helping to steady the hip. The lower glute max was the main hip extensor going up stairs. The glute max was not one uniform block.

When a coach today talks about training the "upper glutes" or the "lower glutes", this is the line of research behind the idea, even if the coach has never heard of it.




**Gluteus medius**, the side glute, in red.

Gray's Anatomy, 1918. Highlight by Mikael Häggström. Public domain




**Gluteus minimus**, the smallest and deepest glute, in red.

Gray's Anatomy, 1918. Highlight by Mikael Häggström. Public domain

In 1989, Gottschalk, Kourosh and Leveau went one step further and redrew the whole side of the hip as one system. The tensor fasciae latae, a small muscle at the front of the hip, balances the body's weight in walking. The gluteus medius, with its three parts, steadies the hip early in each step. The gluteus minimus steadies it later. Three muscles, one team, each with its moment.

PART 5 · THE SCORECARD

## Forty years in seven dates

**1791**
Galvani: muscles and nerves run on electricity.

**1840s**
Du Bois-Reymond measures a working human muscle.

**1957** KEY
Joseph and Williams: the glute max is quiet in standing.

**1965**
Karlsson and Jonsson map its jobs.

**1978**
Soderberg and Dostal: three parts in the medius.

**1983** KEY
Lyons and Perry: upper and lower glute max differ.

**1989**
Gottschalk: the side of the hip as one system.

THE OLD BELIEF THIS CHAPTER TESTS

## "The glutes hold us upright, and the glute max is one muscle doing one job."

**Not supported**

The wires showed a glute max at rest in standing and quiet in level walking. And its upper and lower parts, like the three parts of the side glute, behave differently.

WHAT THIS MEANS FOR TRAINING TODAY

This is why good glute programs do not rely on standing or walking to train the glute max. It needs effort: climbing, rising, extending the hip against load, and turning or lifting the thigh against resistance. And it is why programs include both hip extension work and side work, because different parts of the glutes respond to different jobs.

But the wires left one big question open. If the glute max rests when we stand and walk, why is the human glute so big? That is Chapter 3.




## Watch Chapter 2

The same story as a short animated film with voiceover, 3 minutes 14 seconds. Or play the interactive version and make your guess before the answer.

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## Image credits

- **Opening image and Galvani's lab.** Plate from Galvani, *De viribus electricitatis in motu musculari*, 1791. Public domain. Source
- **Galvani.** Portrait in oils, unknown painter. Museo di Palazzo Poggi, Bologna. Public domain. Source
- **Du Bois-Reymond's experiment.** From *Untersuchungen über thierische Elektricität*, volume 2, plate V. Scan by LovelyOliveGreen, CC BY-SA 4.0. Source
- **Muscle maps.** Henry Gray, *Anatomy of the Human Body*, 1918, figure 434, highlights by Mikael Häggström. Public domain. Source
- **Drawings.** Muscle signal illustration, glute max and gluteus medius schematics drawn by Booty Center.

## How to cite this chapter

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CHAPTER 3 · 1800 TO 2006

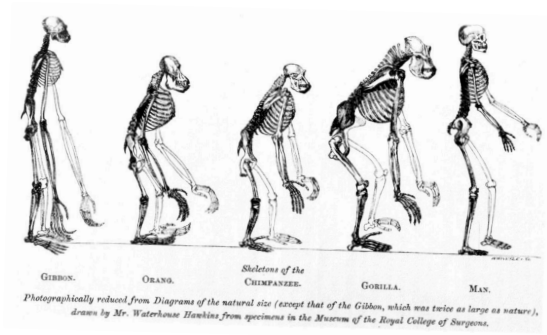
# Why We Have a Butt

Apes have glutes too, but ours are built differently. Three scientists, three answers, and one treadmill that changed the conversation.

Booty Center · 5 minute read · 8 sources

▶ Watch the film

Play the interactive



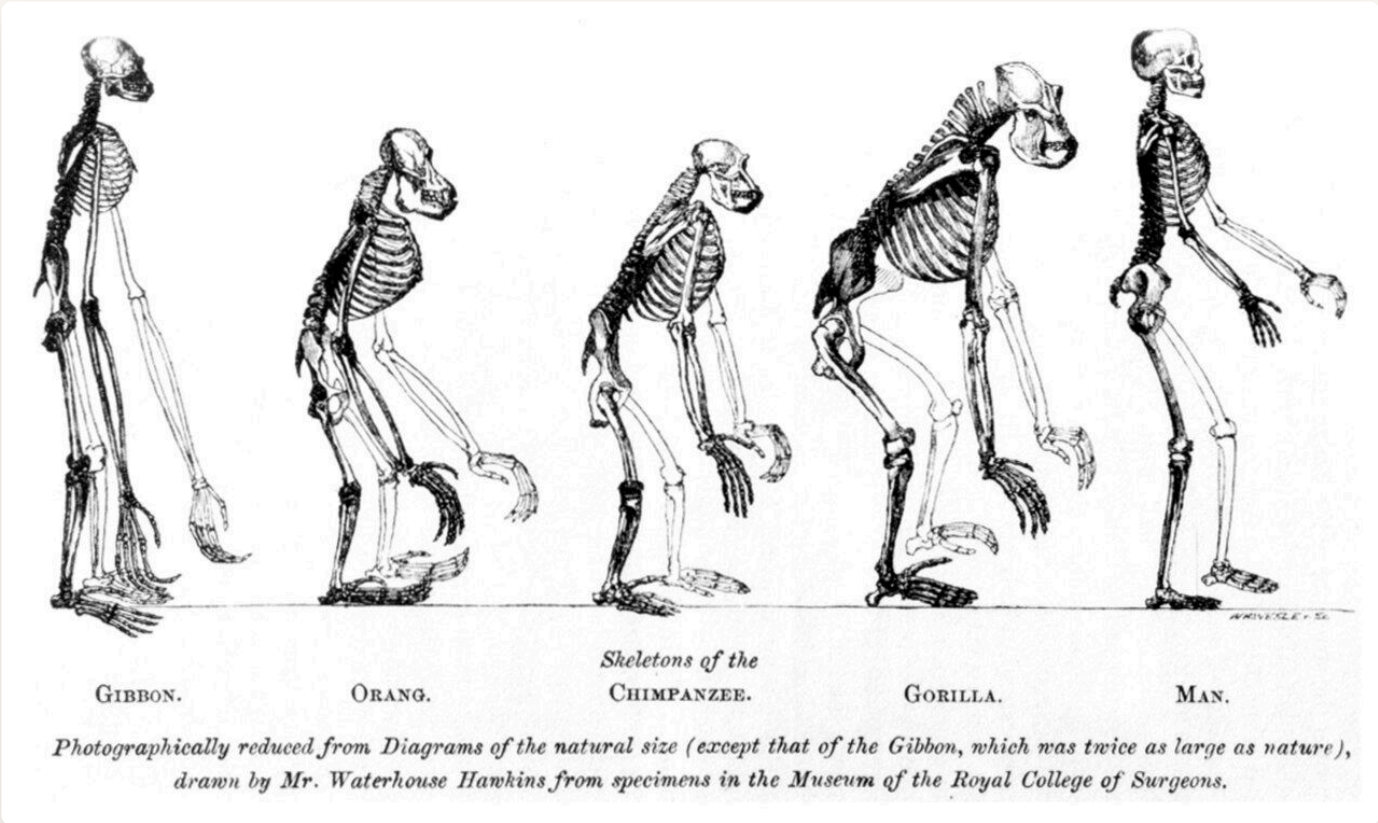

Gibbon, orang, chimpanzee, gorilla and man, from Huxley's book of 1863. Only one of them has a big backside.

Chapter 2 ended with a puzzle. The wires showed that the glute max is mostly quiet when we stand and walk. So why is ours so big? No other primate has a backside like ours. Something in our past must have built it.

This chapter follows three scientists who each gave a different answer, over more than thirty years, and the treadmill test that changed the conversation in 2006. It is also the chapter where we have to be most careful, because the final answer is still not settled.

PART 1 · THE PUZZLE

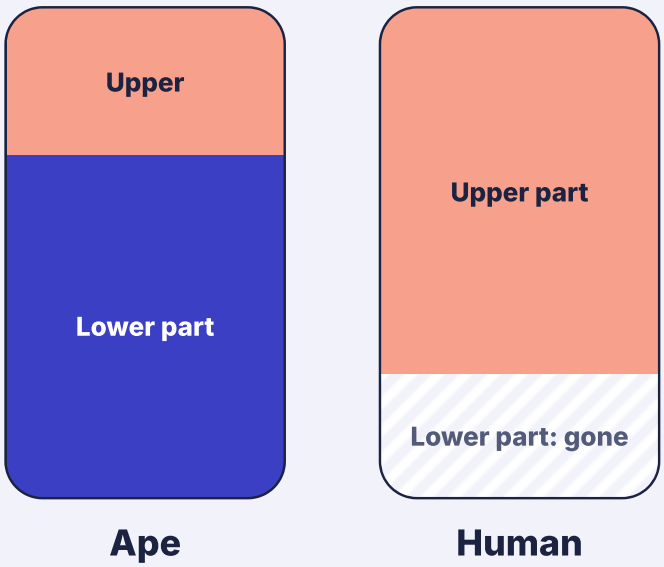
# Same muscle, different build




**Skeletons of the gibbon, orang, chimpanzee, gorilla and man.** The frontispiece of Thomas Huxley's 1863 book on our place in nature, drawn by Benjamin Waterhouse Hawkins. Look at the pelvis and thigh of each one.

Public domain

Apes have glutes too. But ours are built very differently. In apes, most of the glute max sits low, as a big lower part that reaches down toward the knee. Humans lost that lower part. What we kept is the upper part, and in us it is much bigger and thicker than in any ape.




How the glute max is built in apes and in humans. A simplified drawing by Booty Center of the differences described by Stern in 1972 and Lieberman and colleagues in 2006. Proportions are not measured values.

For most of the 1800s and 1900s, the answer to "why?" seemed obvious. We are the only animal that stands upright all day. Our glute must be what holds us up. Georges Cuvier said it around 1800, in the passage you met in Chapter 1, and later anatomists added walking to the list.

The problem, as Chapter 2 showed, is that when scientists in the 1950s and 1960s finally recorded the muscle, it was almost silent in quiet standing and in ordinary walking. So the old answer could not be the whole story. Something else had to explain the human glute.

PART 2 · THREE ANSWERS

# Sideways, tools, or running?

## Answer 1 · Jack Stern, 1972: keeping the trunk from tipping sideways

In 1972 the anatomist Jack Stern compared the glute max across primates in detail. He found three things that are unique to the human version, all in the upper part. It is thicker than in any other primate. It has a new, firm origin on the pelvis. And it gains a new attachment into the tough band on the side of the thigh.

His reading was that this upper part works with the side glutes to keep the trunk from tipping sideways over the standing leg. In other words, it helps balance us on one leg, which is what every step of upright walking and running asks for.

## Answer 2 · Mary Marzke, 1988: controlling the trunk when we use tools



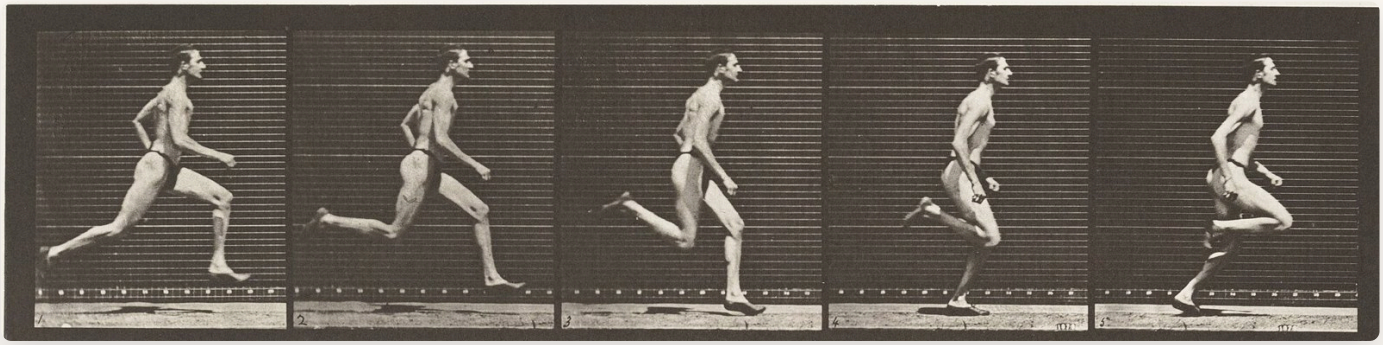
**Striking, throwing and heaving.** Movement photographs by Eadweard Muybridge, taken 1884 to 1886 and published in 1887. Marzke tested movements like these a century later.

USC Digital Library, public domain

The anthropologist Mary Marzke tested a different idea. Early humans did not just walk. They threw, struck, dug and lifted, often with tools in their hands. In 1988 she recorded the glute max in six people while they did these kinds of movements.

The muscle fired strongly when the trunk swung, as in throwing or striking, and worked long and hard when people lifted while bent forward. Her reading was that the human glute max controls the trunk during the forceful, tool-using movements our ancestors made every day.

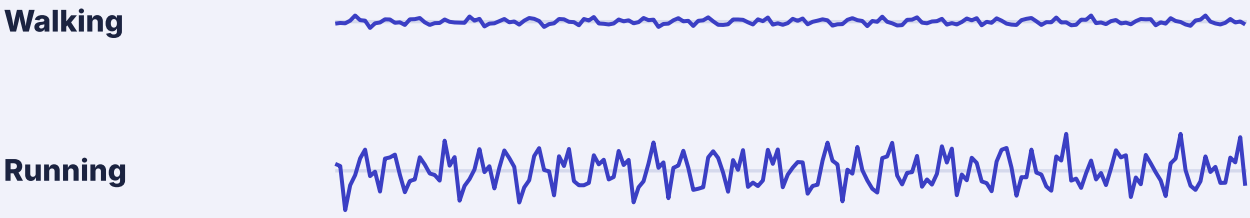
## Answer 3 · Lieberman and colleagues, 2006: running



**A man running,** photographed by Eadweard Muybridge and published in 1887.
USC Digital Library, public domain

In 2004, Dennis Bramble and Daniel Lieberman published a famous paper in Nature arguing that endurance running helped shape the human body. Two years later, Lieberman's team at Harvard tested what that would mean for the glutes. They recorded the glute max while people walked and ran on a treadmill.

In walking, on the level or uphill, the muscle stayed mostly quiet. Then the walk became a run, and the activity rose sharply.




The pattern Lieberman and colleagues reported in 2006, for walking on the level or uphill and for running. Drawn by Booty Center as an illustration, not their recorded traces.

They also worked out what the muscle is doing during a run. It does two jobs. It stops the trunk from tipping forward each time the foot lands. And it slows the swinging leg before the next step. Running, in their view, is where the big human glute earns its keep.

**WHO IS RIGHT?**

Probably all three, in part. **Sideways balance, tool use and running** all describe the same basic job: a muscle that controls the trunk over the leg when the body is working hard.

PART 3 · WHAT IS STILL OPEN

# When did it get bigger?

Here is the honest part. The running idea is strong and widely cited, but it is a hypothesis, not a closed case. To prove it, you would need to know when in our evolution the big glute appeared, and whether that matches when our ancestors started running long distances. Muscle does not fossilise, so scientists have to read it from the shape of fossil hip bones.

The 2006 paper itself calls that evidence equivocal, meaning it can be read more than one way. Good science says so out loud, and so do we.

### c. 1800 IDEA

Cuvier: the glute is for standing upright.

### 1950s to 60s

First recordings: quiet in standing and walking.

### 1972

Stern: it balances the trunk sideways.

### 1988

Marzke: it controls the trunk in tool use.

### 2004

Bramble and Lieberman: humans are built to run.

### 2006 KEY

Lieberman: the glute max wakes up when we run.

THE OLD BELIEF THIS CHAPTER TESTS

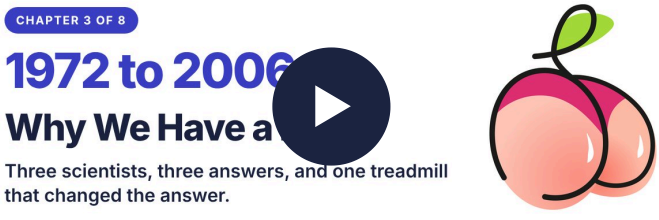
## "The glutes are for standing upright and walking."

**Not supported**

It was taught for generations, but the recordings never backed it up. The muscle is mostly quiet in both. It works hard when we run, climb, lift, throw and balance on one leg.

WHAT THIS MEANS FOR TRAINING TODAY

If the glute max is built for hard work like running, climbing and lifting, it makes sense to train it with hard work, not gentle moves. That is the thread the next chapters follow, from the clinic to the gym.




## Watch Chapter 3

The same story as a short animated film with voiceover, 2 minutes 37 seconds. Or play the interactive version and make your guess before the answer.

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## Image credits

- **Opening image and skeletons.** Benjamin Waterhouse Hawkins, frontispiece to T. H. Huxley, *Evidence as to Man's Place in Nature*, 1863. Public domain. Source
- **Throwing and running.** Eadweard Muybridge, *Animal Locomotion*, 1887, plates 523 and 60. USC Digital Library. Public domain. Source
- **Drawings.** Ape and human glute max, and the treadmill signal illustration, drawn by Booty Center.

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CHAPTER 4 · 1865 TO 2013

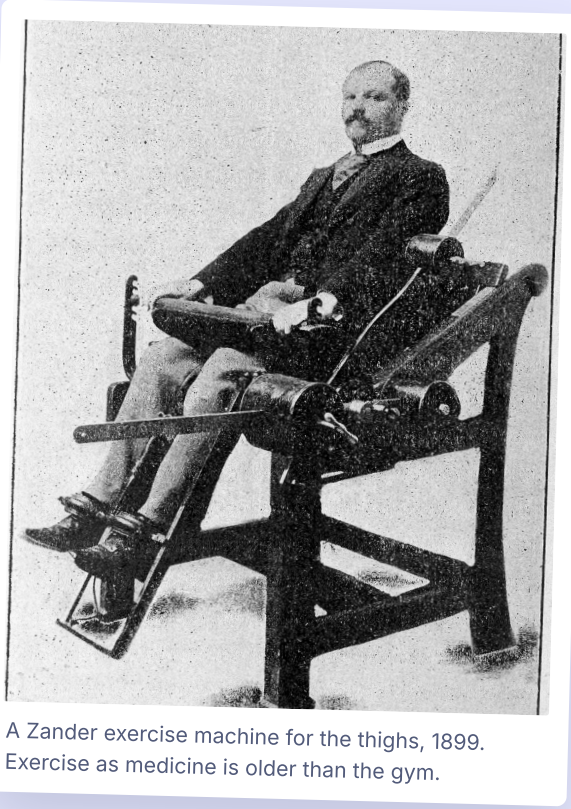
# The Clinic

Long before the gym cared about glutes, the clinic did. Sore backs, sore knees, and the first exercise rankings.

Booty Center · 5 minute read · 12 sources

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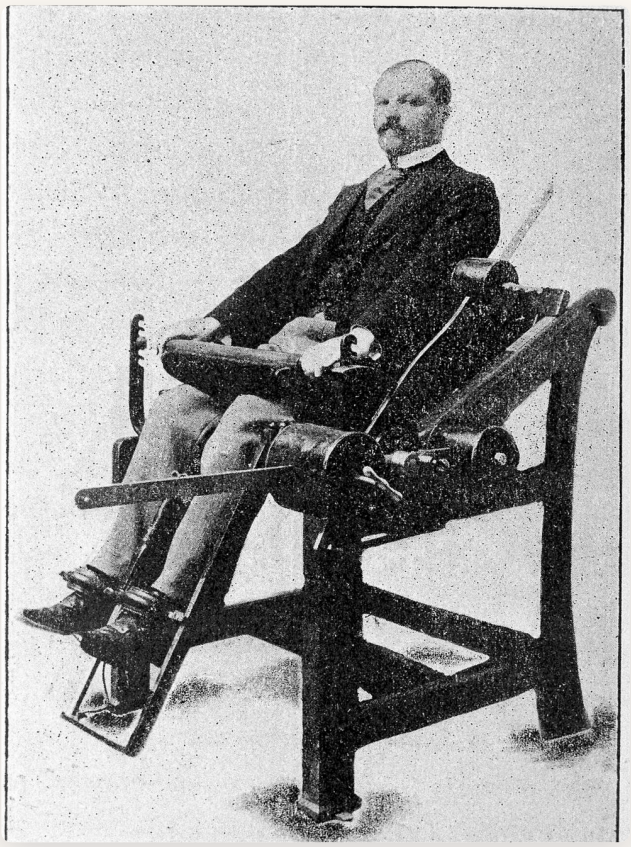
A Zander exercise machine for the thighs, 1899. Exercise as medicine is older than the gym.

Today, glute training is a gym word. But for most of the 20th century, the people who cared most about the glutes were not bodybuilders or coaches. They were doctors and physiotherapists, and they met the glutes through pain: sore backs, and later, sore knees.

This chapter follows how the clinic put the glutes on the map, from a theory about back pain in Prague to a wave of lab studies that ranked rehab exercises. It also shows two ideas from that era that turned out to be too simple.

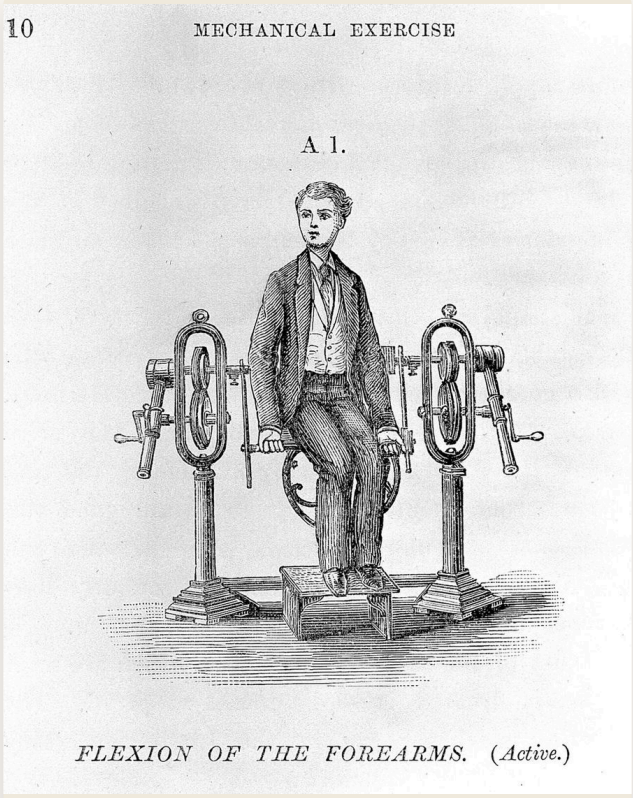
PART 1 · EXERCISE AS MEDICINE

# Machines before gyms



**A Zander machine for the thighs,** shown in a book on exercise therapy from 1899.

Wellcome Collection, CC BY 4.0




**Flexion of the forearms,** one of the machines at the Zander Institute, from an 1883 guide.

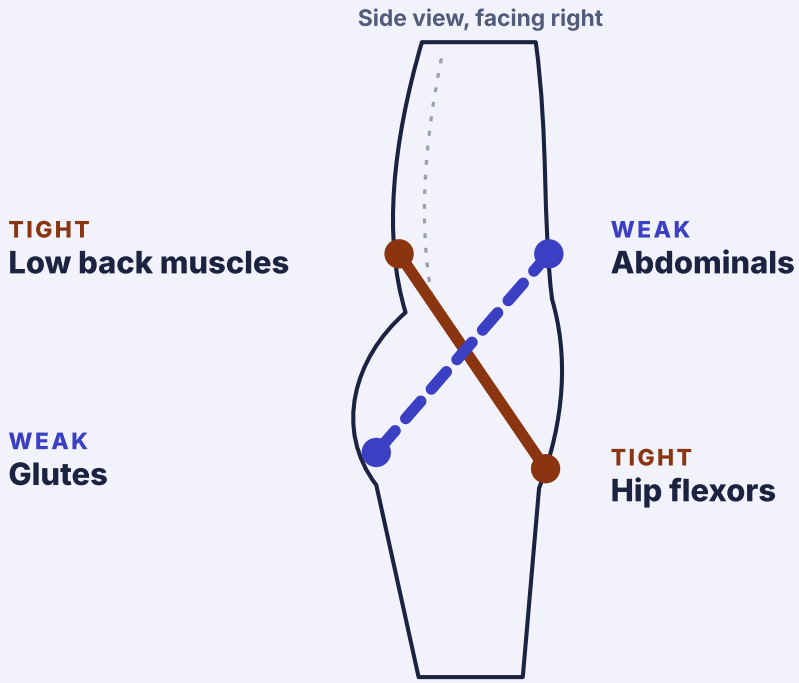
Wellcome Collection, CC BY 4.0

The idea that exercise can treat the body is old. In 1865, the Swedish physician Gustav Zander opened an institute in Stockholm where patients exercised on machines, each built for one movement. Zander institutes spread across Europe and beyond. Many of these machines look strangely like the ones in gyms today.

But for a long time, the glutes were not a special target. That changed when the clinic started to link them to two of its most common problems.

PART 2 · THE BACK

# Janda's crossed pattern




Janda's lower crossed pattern. Tight low back muscles and hip flexors on one line, weak abdominals and glutes on the other. Schematic drawn by Booty Center.

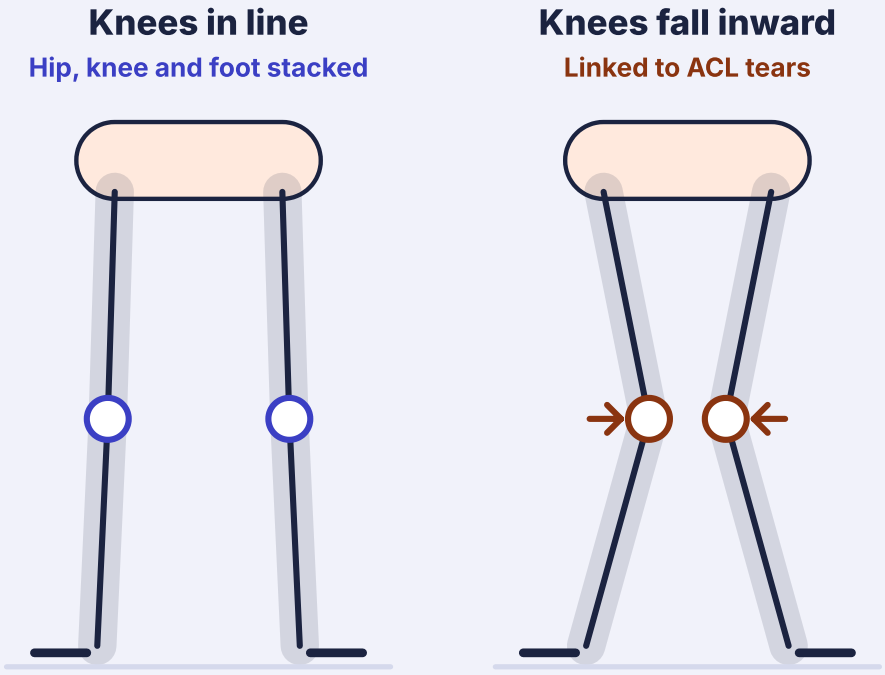
In 1979, the Czech physician Vladimir Janda described a pattern he saw again and again in his back pain patients in Prague. The hip flexors at the front of the hip and the muscles of the low back were tight. The abdominals and the glutes were weak. Drawn on the body, the tight pair and the weak pair cross each other like an X. He called it the lower crossed syndrome.

His original paper was written in German for a congress, and most people know it only through later books and articles. But the idea spread fast through physiotherapy. For the first time, weak glutes had a named place in back pain care.

In 1993, Janda and colleagues tested whether the glutes could be retrained. Fifteen healthy people walked in wobbly balance shoes for one week. Afterwards, their glutes fired harder and earlier when they walked. The muscles could be trained to respond.

PART 3 · THE KNEE

# When the knee falls inward




Landing from a jump, seen from the front. Hewett's athletes who later tore an ACL landed with the knee falling further inward. Drawn by Booty Center.

Then the knee joined the story. In 2005, Timothy Hewett and colleagues tested how 205 female athletes landed from a jump, then followed them through their season. Nine of them later tore their ACL, a key knee ligament. Those nine had landed with the knee falling inward about 8 degrees more than the others, and with about 2.5 times the inward load on the knee.

Why would the knee fall inward? One reason sits above it. The hip muscles, especially the side glutes, help control where the thigh goes when you land, run or squat.

In 2010, Christopher Powers pulled the evidence together in an influential review. Poor muscle control at the hip, he argued, can change how the knee moves and how it is loaded. He linked it to ACL injuries, IT band syndrome and kneecap pain. His conclusion was simple: knee rehab should train the hip too.

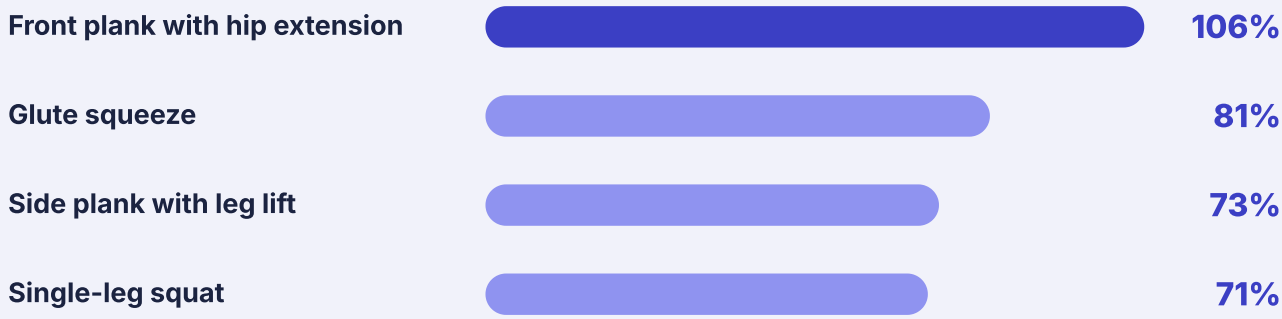
PART 4 · THE RANKING WAVE

# Which exercise works the glutes best?

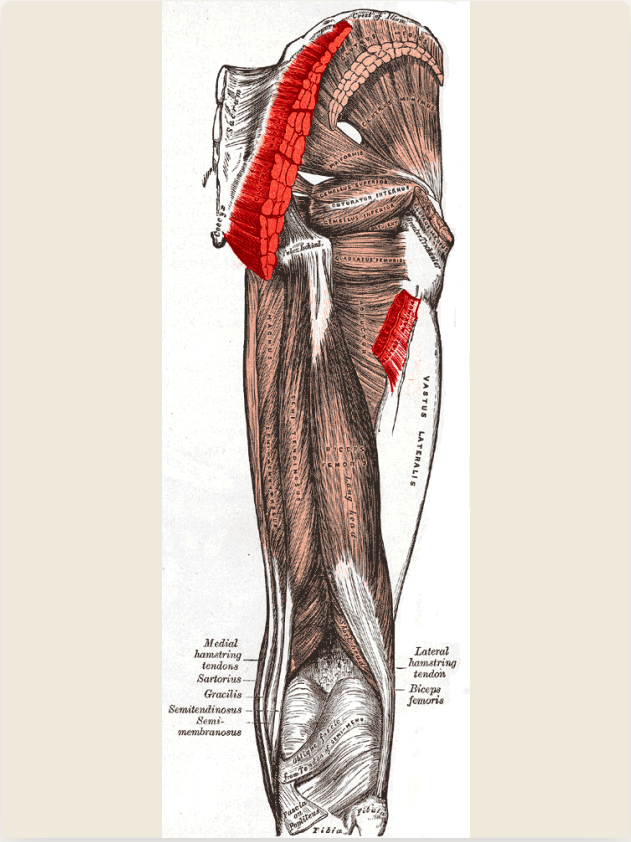
Now therapists had a practical problem. If the glutes matter for backs and knees, which exercises actually work them? From 2005, lab after lab wired people up with EMG and ranked the classic rehab exercises: Bolgla and Uhl in 2005, Ayotte and Ekstrom in 2007, Distefano in 2009, and Boren in 2011.

The 2011 study by Boren and colleagues tested 18 exercises on 24 healthy people. The results, as a percent of each person's maximum effort, looked like this.

**Glute max, peak signal, Boren et al. 2011**

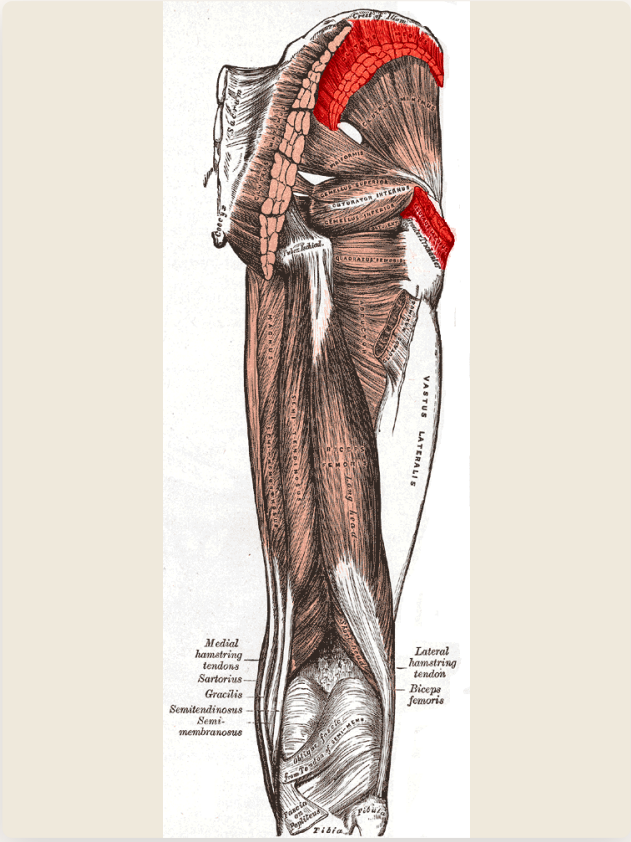



The top four for the glute max. For the side glute, the side plank with leg lift came first, at 103 percent. Values above 100 percent are possible because the reference test is not always a person's true maximum.




**Glute max,** the big outer muscle.

Gray's Anatomy, 1918. Highlight by Mikael Häggström. Public domain




**Glute medius,** the side glute.

Gray's Anatomy, 1918. Highlight by Mikael Häggström. Public domain

These rankings were hugely useful for rehab. They told therapists which simple, low-load exercises switch the glutes on. But they were soon read in a way their authors could not prove: as a guide to building muscle. More on that in a moment.

PART 5 · GLUTEAL AMNESIA

# Does pain switch the glutes off?

Meanwhile, the Canadian spine researcher Stuart McGill gave the clinic a phrase people remembered: gluteal amnesia, the idea that in people with back or hip trouble the glutes "forget" how to fire. The term is usually credited to his book on low back disorders.

In 2013, his lab tested a version of it. Twelve patients had fluid injected into one hip joint as part of a scan. Right afterwards, the glute max on that side fired less in a bridge exercise. Nine healthy people, with no injection, showed no change. So irritating a joint can, at least briefly, turn down the muscle around it.

But "pain switches the glutes off" turned out to be too simple as a general rule. A 2013 review of people with kneecap pain found the side glute firing late during tasks like stair climbing. The glute max, though, was firing more on stairs, not less, though the evidence for that part was limited.

THE OLD BELIEF THIS CHAPTER TESTS

## "Pain switches the glutes off, and a higher EMG signal means more growth."

**Too simple**

Pain can change how the glutes fire, but not always by switching them off. And the 2011 ranking paper suggested that a higher signal goes with more growth. That is a prediction, not a result. Chapter 8 shows what happened when scientists finally tested it.

WHAT THIS MEANS FOR TRAINING TODAY

The clinic gave us two lasting lessons. Strong, well-controlled glutes matter for healthy backs and knees. And there is a big menu of simple exercises that switch the glutes on, which is useful for warm-ups and rehab. Building muscle size is a different question, and it needs a different kind of evidence.




## Watch Chapter 4

The same story as a short animated film with voiceover, 3 minutes 23 seconds. Or play the interactive version and make your guess before the answer.

**Play the interactive**

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## Image credits

- **Zander machine for the thighs.** From F. Lagrange's book on Zander exercise therapy, 1899. Wellcome Collection, CC BY 4.0. Source
- **Zander Institute.** *Mechanical Exercise, a Means of Cure*, 1883, 'Flexion of the forearms'. Wellcome Collection, CC BY 4.0. Source
- **Muscle maps.** Henry Gray, *Anatomy of the Human Body*, 1918, figure 434, highlights by Mikael Häggström. Public domain. Source
- **Drawings and chart.** Lower crossed pattern, knee landing and ranking chart drawn by Booty Center from the cited papers.

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CHAPTER 5 · 1890S TO 2003

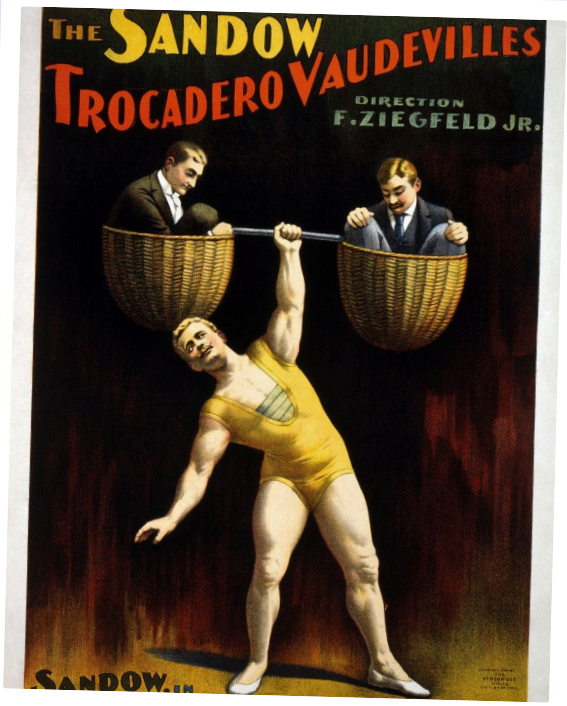
# The Iron

While clinics studied weak glutes, lifters built machines for strong ones. A Soviet bench, a broken back and a training bible.

Booty Center · 4 minute read · 7 sources

▶ Watch the film

Play the interactive



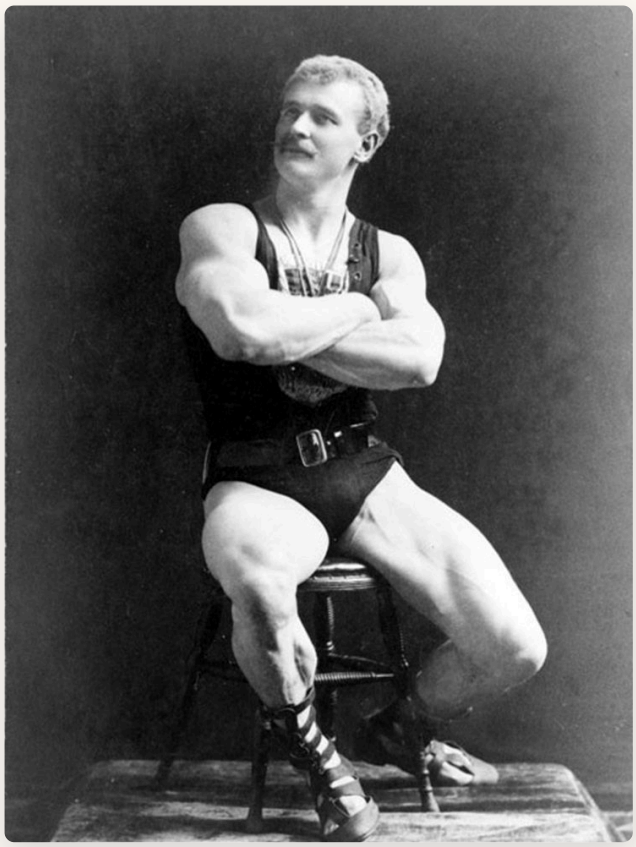

Sandow's theatre poster, 1894. The iron game began on stage.

While physiotherapists studied weak glutes, the people on the gym floor were busy with strong ones. Powerlifters, weightlifters and sprint coaches did not care much about EMG. They cared about lifting more and running faster, and they built machines and methods to get there.

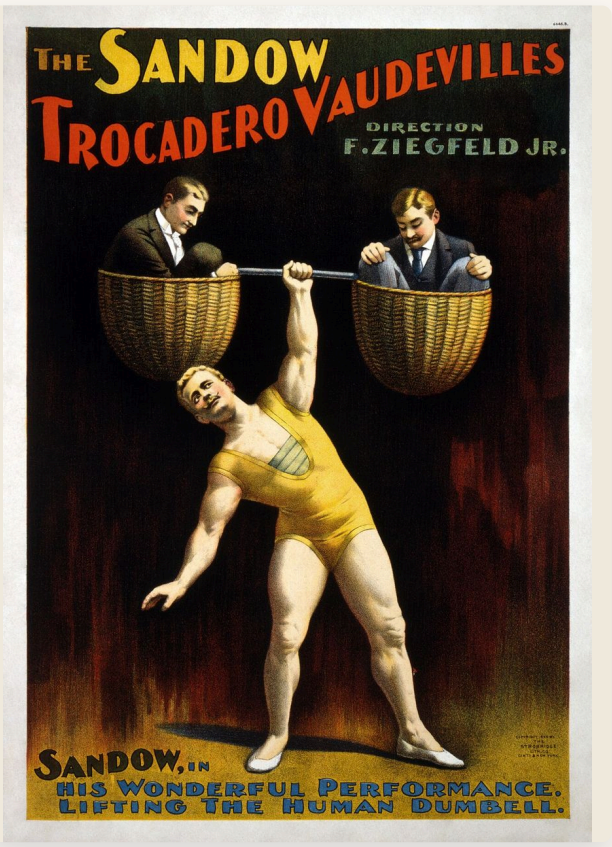
This chapter tells three stories from that world: a Soviet machine that crossed the Iron Curtain, a powerlifter with a broken back, and a training book that quietly showed a new kind of bridge. None of them was about the glutes alone. All of them ended up shaping how we train the glutes today.

PART 1 · BEFORE THE MACHINES

# The strongman era



**Eugen Sandow**, around the 1890s.
Photograph by Benjamin J. Falk. Public domain




**Theatre poster, 1894.** Sandow lifting the 'human dumbbell'.
Library of Congress. Public domain

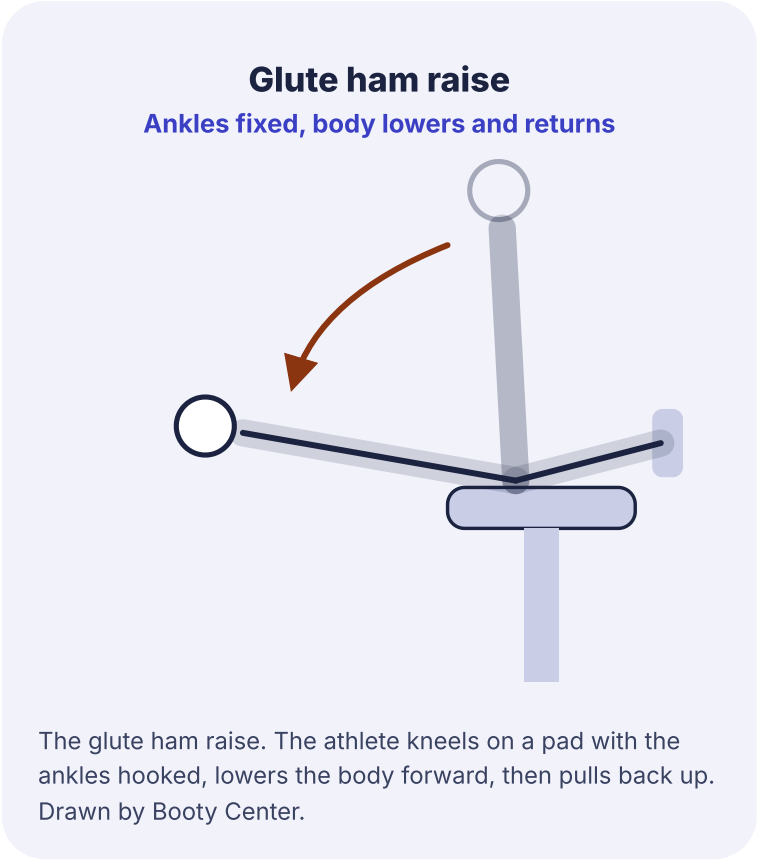
Lifting heavy things for show is ancient, but the modern iron game took shape in the 1890s. The Prussian-born strongman Eugen Sandow filled theatres in Europe and America with feats of strength and muscle poses. In 1901 he ran a famous physique contest in London, and he is often called the father of modern bodybuilding.

For most of the next century, though, nobody in the gym talked about glutes as their own target. Squats and deadlifts built the legs and back. The glutes simply came along for the ride.

PART 2 · A SOVIET MACHINE

# The glute ham raise crosses the Iron Curtain

Michael Yessis was a biomechanist at California State University, Fullerton. His mission was to bring Soviet sports training to the United States. For years, his journal, Soviet Sports Review, translated Soviet research for English readers, at a time when the Soviet Union dominated many Olympic sports.




The glute ham raise. The athlete kneels on a pad with the ankles hooked, lowers the body forward, then pulls back up. Drawn by Booty Center.

On his trips to the Soviet Union in the 1980s, Yessis came across a Soviet exercise bench for what we now call the glute ham raise. In the mid-1980s he worked with an American company, Polaris Equipment, on an American version: the glute ham developer. He is often called its inventor. It is fairer to say he made it popular in the West, because the Soviet version came first.

PART 3 · A BROKEN BACK

# Louie Simmons flips the exercise

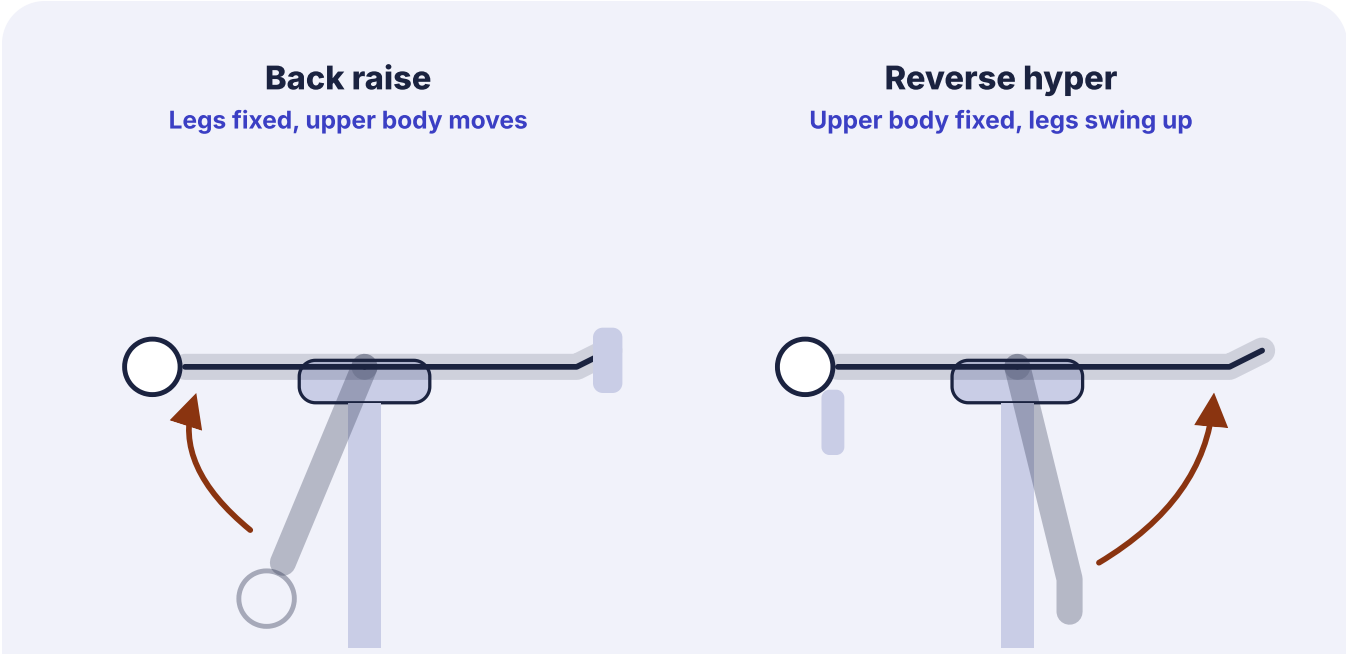


**Louie Simmons** at a bench press championship in Cleveland, 2004.

Photograph by Andrey Vasilyev, cropped. CC BY-SA 4.0

Louie Simmons was a powerlifter who later founded the famous Westside Barbell gym in Columbus, Ohio. In 1973 he broke his back. Normal back raises, the usual exercise to strengthen the lower back, hurt too much to do.

So he flipped the exercise. In a back raise, the legs are fixed and the upper body moves. Simmons fixed the upper body on a pad and swung the legs up instead. When he broke his back again in 1983, he used his machine to rehab it.




The back raise and the reverse hyper. Same muscles, opposite ends moving. Drawn by Booty Center.

On 18 October 1994 he received US patent 5,356,359, titled "Method and apparatus for improved lower back exercise". The reverse hyper works the low back, the hamstrings and the glutes, and today it is in gyms all over the world.

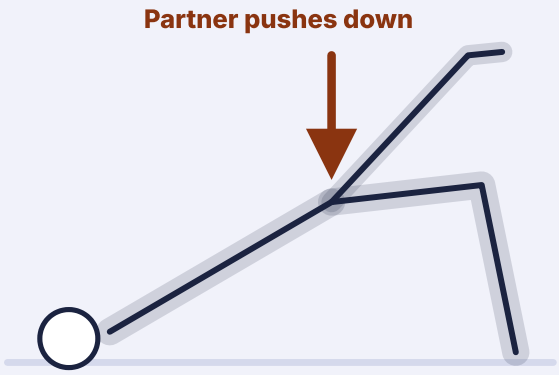
PART 4 · A TRAINING BIBLE

## Supertraining and the loaded bridge

The third piece was a book. Supertraining was written by the Soviet sports scientist Yuri Verkhoshansky and the South African scientist Mel Siff, and it became a kind of bible for strength coaches. Its fifth edition, from 2003, shows partner-resisted bridges, on one leg and on two, as exercises for track and field athletes: the athlete lies on the back and drives the hips up while a partner pushes down.

### Partner-resisted bridge

Hips drive up against the push




A partner-resisted bridge, drawn by Booty Center to show the idea. This is not the book's own illustration.

Bret Contreras, whose story is Chapter 7, later named these drawings as the start of the hip thrust's story. In other words, the idea of loading the bridge was already on paper before anyone put a barbell across their hips on a bench.

THE COMMON THREAD

A Soviet bench, a powerlifter's rehab machine and a sprint coach's bridge all train the same thing: **hip extension under load**. The goals were a stronger lift, a healthier back and a faster sprint. The glutes came along for the work.

**1890s**
Sandow and the strongman era.

**1973**
Simmons breaks his back.

**1980s**
Yessis meets the Soviet glute ham raise.

**Mid 1980s**
The American glute ham developer.

**1994** KEY
Reverse hyper patent.

**2003** KEY
Supertraining shows loaded bridges.

THE OLD BELIEF THIS CHAPTER TESTS

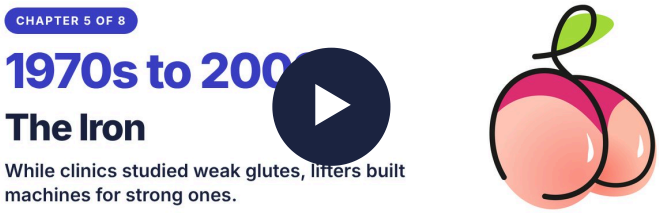
## "Each great glute exercise has one inventor and one moment."

**Not supported**

The Soviet glute ham raise came before the American machine. Loaded bridges came before the hip thrust. Most gym inventions grow out of earlier ideas, and good history gives credit along the whole chain.

**WHAT THIS MEANS FOR TRAINING TODAY**

Hip extension under load is the core of strong glutes, whether it comes from a glute ham raise, a reverse hyper, a deadlift or a bridge. Which tool you use is less important than training that movement hard and often enough. Chapter 8 shows what the research says about choosing between them.




## Watch Chapter 5

The same story as a short animated film with voiceover, 2 minutes 46 seconds. Or play the interactive version and make your guess before the answer.

**Play the interactive**

## Sources


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## Image credits

- **Eugen Sandow.** Photograph by Benjamin J. Falk, 1890s. Public domain. Source
- **Sandow poster.** The Sandow Trocadero Vaudevilles, 1894. Library of Congress, Prints and Photographs. Public domain. Source
- **Louie Simmons.** Photograph by Andrey Vasilyev, 4 December 2004, cropped by Booty Center. CC BY-SA 4.0. Source
- **Drawings.** Glute ham raise, back raise and reverse hyper, and partner-resisted bridge drawn by Booty Center.

## How to cite this chapter

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CHAPTER 6 · 1980 TO 1992

# Leotards and VHS

In the 1980s, the gym moved into the living room. The glutes stopped being just a muscle and became a goal.

Booty Center · 4 minute read · 10 sources

▶ Watch the film

Play the interactive




A VHS tape. In the 1980s, this was the gym.

For a hundred years, the glutes belonged to anatomists, physiologists and therapists. Then, in the 1980s, they went pop. The gym moved into the living room, and all you needed was a video recorder, a tape and a leotard.

This is the chapter where the glutes stopped being just a muscle and became a goal. The science was not there yet. But the demand was, and it changed what people wanted from training.

PART 1 · THE LIVING ROOM

# A VCR, a tape and a leotard



**A home video recorder.** Machines like this turned living rooms into gyms.

Museo Nazionale Scienza e Tecnologia Leonardo da Vinci, Milan. CC BY-SA 4.0




**A VHS tape.** The format that carried the workout boom.

Photograph by Ggga21. CC BY 4.0

On 24 April 1982, the actor Jane Fonda released Jane Fonda's Workout on video. It was the first video that was not a movie to top the home video sales charts. The routine was built with the instructor Leni Cazden at their studio in Beverly Hills. Over the years, the series sold about 17 million videos.

Muscle on women was going mainstream at the same time. On 30 August 1980, Rachel McLish won the first Ms. Olympia contest, in Philadelphia. Her books, Flex Appeal by Rachel in 1984 and Perfect Parts in 1987, both became New York Times bestsellers.

A LEAD WE ARE STILL CHECKING

Bret Contreras has pointed to a bridge-style move in one of McLish's books as the earliest **frog pump** he has found. We have not seen the page ourselves yet, so we report it as his claim, not as a fact. If you own the book, tell us the page.

JF

**Jane Fonda's Workout, 1982**

Photos and the original cover are copyrighted, so we link to them.

See it on Wikipedia →

RM

**Rachel McLish**

First Ms. Olympia, 1980.

See her on Wikipedia →

BS

**Buns of Steel, 1987**

Greg Smithey's tape and its famous cover.

See it on Wikipedia →

PART 2 · ANCHORAGE

# The tape that named the goal

The most famous glute tape of all came from an unlikely place. In Anchorage, Alaska, a former pole vaulter named Greg Smithey ran an exercise studio. His classes were full, but the studio was deep in debt. Then, as he tells the story, a student said after class: wow, our buns feel like steel.

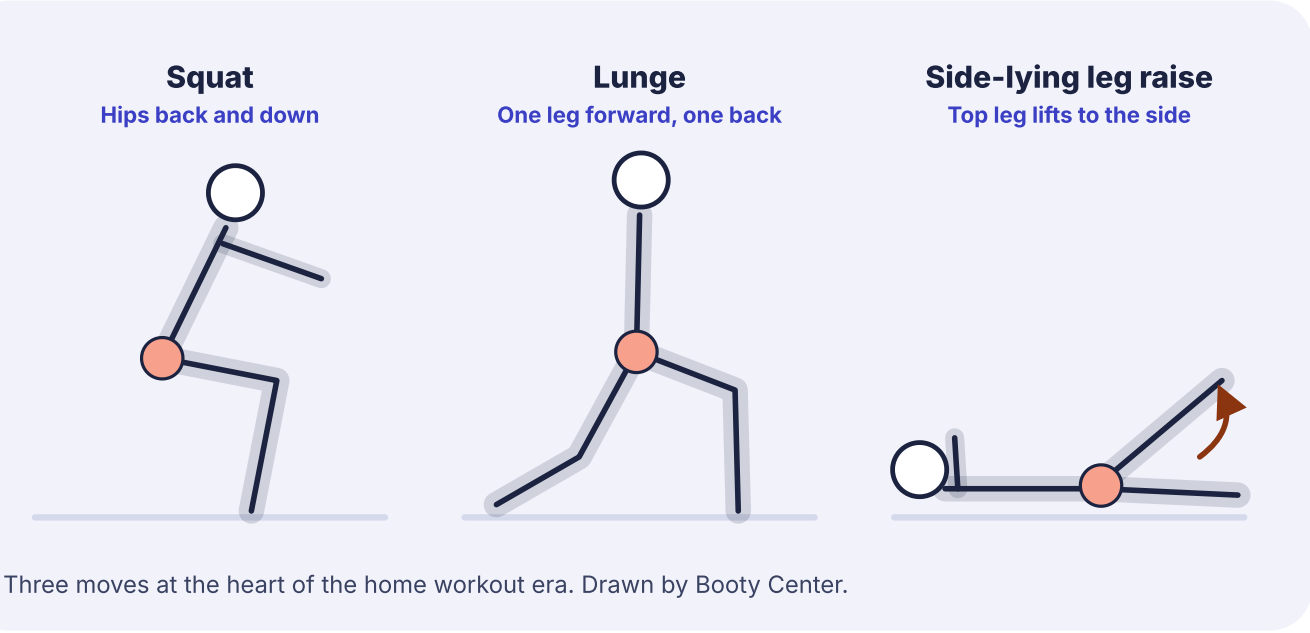
In 1987 he filmed a cheap butt workout on video and called it Buns of Steel. The first tape sold for 25 dollars, and sales were slow. Then he sold the distribution rights to a company called the Maier Group, and the tape took off. The cover showed his own backside, as the promise.

The Maier Group wanted a woman to lead the next tapes. Tamilee Webb, a San Diego instructor with a master's degree in exercise science, fronted Buns of Steel 3 in 1989. Her workout was built on squats and lunges. In 1992, the original tape was still the fifth best selling exercise video of the year. By her own count, her series sold more than ten million videos, though counts in her interviews vary.

PART 3 · THE SHIFT

# From a muscle to a goal

Something had changed. Before, the glutes were a muscle that anatomists argued about and therapists rehabbed. Now they were a goal that millions of people trained for, in their living rooms, every morning. The science would take decades to catch up with the demand.




Three moves at the heart of the home workout era. Drawn by Booty Center.

It is easy to laugh at leotards and leg warmers. But the basic moves were not silly. Webb's tape was built on squats and lunges, which are still staples today. And when a lab ranked twelve common glute exercises in 2009, the side-lying leg raise, a classic of the video era, came first for the side glute, at 81 percent of a maximum effort.

**1980**
Rachel McLish wins the first Ms. Olympia.

**1982** KEY
Jane Fonda's Workout tops the video charts.

**1984**
Flex Appeal by Rachel.

**1987** KEY
Buns of Steel is filmed in Anchorage.

**1989**
Tamilee Webb fronts Buns of Steel 3.

**2009**
Lab ranks the side-lying leg raise first for the side glute.

THE OLD BELIEF THIS CHAPTER TESTS

## "The 1980s workout boom was all fluff."

**Not supported**

Much of it was built on squats, lunges and leg raises, and a 2009 lab ranking put the side-lying leg raise first for the side glute. What the era lacked was not good moves but good evidence on how to build muscle.

WHAT THIS MEANS FOR TRAINING TODAY

Simple moves like squats, lunges and side-lying leg raises still have a place, especially for beginners, warm-ups and the side glutes. The real lesson of the era is demand: people wanted bigger, stronger glutes long before science could tell them how. Chapters 7 and 8 are about closing that gap.




## Watch Chapter 6

The same story as a short animated film with voiceover, 2 minutes 42 seconds. Or play the interactive version and make your guess before the answer.

**Play the interactive**

## Sources


1. Jane Fonda's Workout. Released 24 April 1982. First non-theatrical home video to top the sales charts. Wikipedia.
2. Mental Floss. How Jane Fonda's Workout conquered the world. Routine created with Leni Cazden.
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10. Distefano LJ, Blackburn JT, Marshall SW, Padua DA. Gluteal muscle activation during common therapeutic exercises. *Journal of Orthopaedic and Sports Physical Therapy*. 2009;39:532-540. doi:10.2519/jospt.2009.2796. Side-lying hip abduction 81% of maximum, top for the gluteus medius.


## Image credits

- **Video recorder.** Panasonic VHS recorder, Museo Nazionale Scienza e Tecnologia Leonardo da Vinci, Milan. CC BY-SA 4.0. Source
- **VHS tape.** Photograph by Ggga21. CC BY 4.0. Source
- **Drawings.** Squat, lunge and side-lying leg raise drawn by Booty Center.
- **Not shown.** Photos of Jane Fonda, Rachel McLish, Greg Smithey and Tamilee Webb, and the original video covers, are under copyright. We link to them instead.

## How to cite this chapter

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CHAPTER 7 · 2006 TO 2019

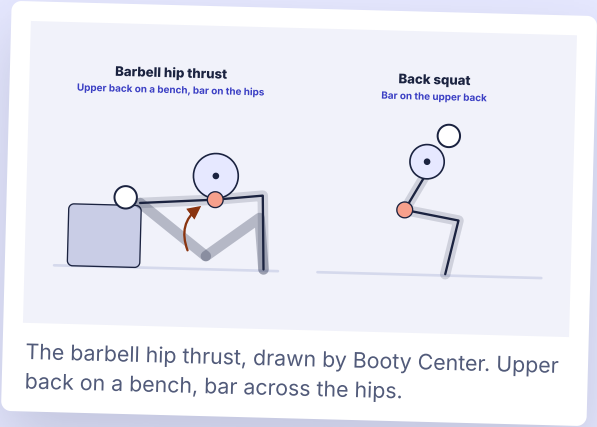
# The Hip Thrust Era

A fight on TV, a garage in Arizona and one new lift. How the barbell hip thrust went from a dip belt to the lab.

Booty Center · 6 minute read · 8 sources

▶ Watch the film

Play the interactive




The barbell hip thrust, drawn by Booty Center. Upper back on a bench, bar across the hips.

Before 2006, if you wanted bigger glutes, the advice was squats, lunges and deadlifts. Good exercises, but none of them was built around the glutes. Then a strength coach in Arizona went out to his garage one night, and the glute world got its own signature lift.

This chapter follows the barbell hip thrust from that garage to the lab. It is a story about a real step forward, and about one very common misreading of the science that came with it.

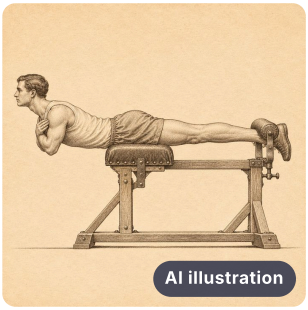
BEFORE 2006

## The glute exercise family tree

The hip thrust did not come from nowhere. By 2006, glute exercises already came in four families: moves that lift the body against gravity, bridges, side glute lifts, and squats. Here is each family as our sources record it, from the old gym staples to the moves that later MRI scans tested.

## Hinge

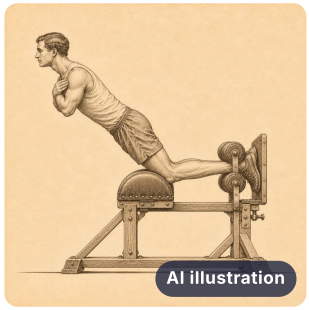
Lift the body or legs against gravity




### Back raise

**Old gym staple**

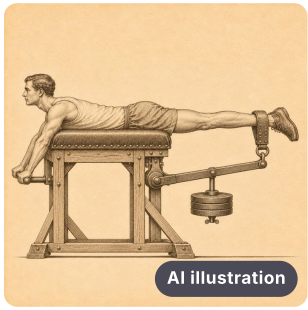
Legs fixed, the upper body lifts.




### Glute ham raise

**Soviet; US version mid 1980s**

Michael Yessis brought it west. Chapter 5.



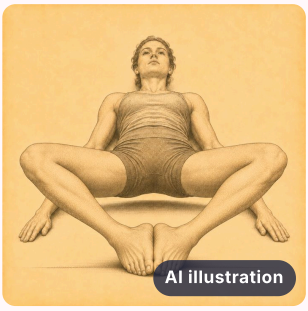

### Reverse hyper

**Idea 1973 · patent 1994**

Louie Simmons flipped the back raise. Chapter 5.

## Bridge

Hips push up from the floor or a bench

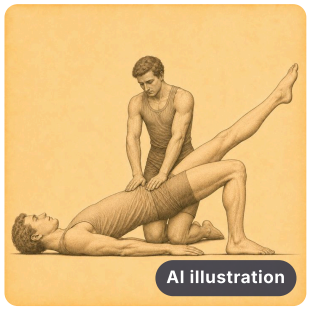



### Frog pump

**1980s?**

Bret Contreras points to a Rachel McLish book. We have not seen the page.

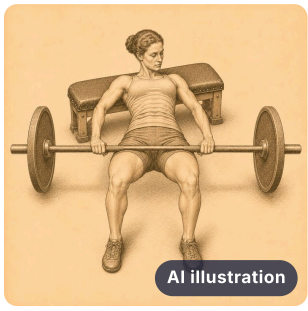
**Lead, not yet confirmed**




### Partner-resisted bridge

**Supertraining, 2003 edition**

Loaded bridges for track athletes, as Bret Contreras describes them. Chapter 5.



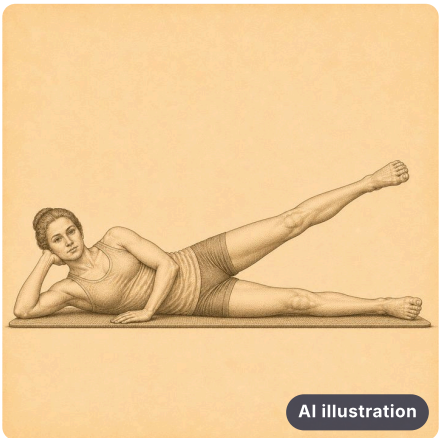

### Barbell hip thrust

**2006 · in print 2011**

Shown at the start, before the hips drive up. A garage in Arizona, then the lab. Chapter 7.

## Side glute

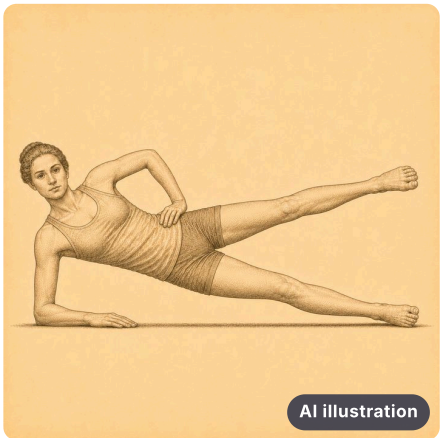
Lift the leg out to the side




### Side-lying leg raise

**1980s tapes · ranked 2009**

Top for the side glute at 81% of maximum. Chapter 6.



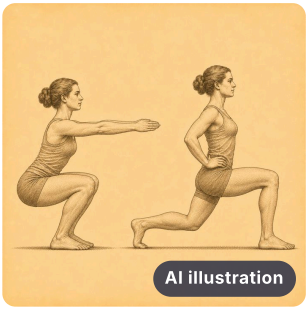

### Side plank with leg lift

**Ranked 2011**

Side glute signal 103% of maximum. Chapter 4.

**Squat and press**

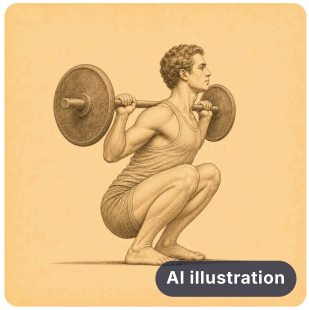
Proven by MRI scans of growth




**Squat and lunge**

**1980s home videos**

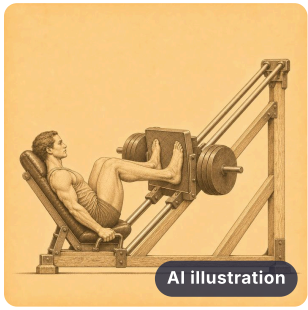
The base of Buns of Steel 3, 1989. Chapter 6.




**Full squat**

**MRI 2019**

Glute max grew 6.7% with full squats, 2.2% with half. Chapter 8.




**Leg press**

**MRI 2026**

Glute max grew 15.4%; knee extension, none. Chapter 8.

All pictures in this tree are engraving-style illustrations made with AI for this magazine. They are not historical images. Years show when each move appears in the sources we cite, not the first time anyone did it. A dashed card is a lead we are still checking.

PART 1 · THE GARAGE

# A fight on TV and a dip belt

According to his own account, on 10 October 2006 the strength coach Bret Contreras was watching a fight on TV. One fighter was pinned on his back. Contreras wondered why the fighter did not buck harder with his hips to throw the other man off. He walked out to his garage gym and tried to load that same movement.

His first version hung four 45 pound plates from a dip belt. By December he had built a first machine. Before long he found that a plain bench and a barbell did the job: upper back on the bench, barbell across the hips, drive the hips up.

**Barbell hip thrust**

**Upper back on a bench, bar on the hips**

**Back squat**

**Bar on the upper back**



The barbell hip thrust next to the back squat. In the thrust, the load sits on the hips and the glutes drive them up. Drawn by Booty Center.

Chapter 5 showed that loaded bridges were already on paper in Supertraining. Contreras himself has credited those drawings. What he added was the bench, the barbell, a name, and years of persistent promotion that turned it into the best known glute exercise in the world.

PART 2 · INTO PRINT

# From blog to journal to bestseller

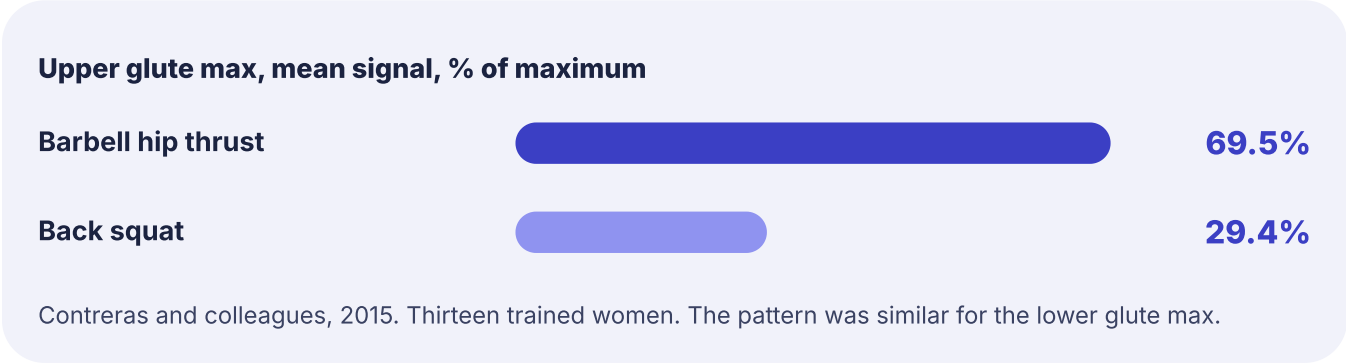
In 2011, Contreras, John Cronin and Brad Schoenfeld wrote the technique up in the Strength and Conditioning Journal, a journal read by coaches. The lift now had a name in print: the barbell hip thrust.

In 2013, with co-author Kellie Davis, he published Strong Curves, a training book written for women, with the hip thrust as one of its main glute exercises. In 2019, with Glen Cordoza, he published Glute Lab, a 608 page manual on one muscle group. Glute training had become its own field.

PART 3 · THE LAB

# How much bigger was the signal?

In 2015, Contreras and colleagues took the lift into the lab. Thirteen trained women did the hip thrust and the back squat with electrodes on their glutes. In the upper glute max, the hip thrust gave a mean signal of 69.5 percent of maximum. The back squat gave 29.4 percent. More than double.




Contreras and colleagues, 2015. Thirteen trained women. The pattern was similar for the lower glute max.

A follow-up in 2016 compared barbell, band and American hip thrust variations in the same way. Then, in 2017, came a training study. Adolescent male athletes did six weeks of either hip thrusts or front squats. The front squat group looked better for the vertical jump. The hip thrust group looked better for short sprints. It was early evidence, and it measured performance, not muscle size.

READ THE FINE PRINT

The 2015 paper measured the **signal** during a lift, not muscle growth over weeks. It said so, and asked for training studies to find out. That difference matters for the next part of the story.

PART 4 · THE MISREADING

# Bigger signal, more muscle?

Many readers, coaches and influencers took the bigger signal to mean more muscle. If the glutes light up more in a hip thrust, surely it must grow them more? It is an easy step to take. The 2015 paper never claimed it.

In 2018, Andrew Vigotsky and colleagues published a careful warning. EMG, they explained, is affected by many things besides how hard a muscle works, from electrode placement to skin and fat. Using the size of the signal to predict long-

term growth is often not supported by the evidence. You have to test growth directly.

**2006**
The garage: a loaded hip bump.

**2011** KEY
The barbell hip thrust in print.

**2013**
Strong Curves.

**2015** KEY
Lab: hip thrust signal more than double the squat.

**2017**
First training study: sprints and jumps.

**2018**
Vigotsky: signal does not predict growth.

**2019**
Glute Lab, 608 pages.

THE OLD BELIEF THIS CHAPTER TESTS

## "A bigger EMG signal means more muscle growth."

**Not supported**

The hip thrust really does light up the glutes more than the squat. But a bigger signal during a lift is not the same as more growth over months. The original paper never said it was, and in 2018 Vigotsky and colleagues showed why the leap is often wrong.

WHAT THIS MEANS FOR TRAINING TODAY

The hip thrust is a great tool for loading the glutes hard through hip extension, and many people find it the easiest way to feel them work. But do not choose exercises by EMG rankings alone. Whether one lift grows the glutes more than another is a question for training studies. Chapter 8 tells you what they found.




## Watch Chapter 7

The same story as a short animated film with voiceover, 2 minutes 51 seconds. Or play the interactive version and make your guess before the answer.

**Play the interactive**

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## Image credits

- **Drawings and chart.** Hip thrust and back squat, and the 2015 signal chart, drawn by Booty Center from the cited papers.
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CHAPTER 8 · 2015 TO 2026

# The Proof Era

For a decade we ranked glute exercises by how hard the muscle fired. Then scientists scanned the muscle itself.

Booty Center · 5 minute read · 7 sources

▶ Watch the film

Play the interactive




An MRI scanner. The tool that finally measured glute growth.

For more than a decade, glute exercises were ranked by one number: how hard the muscle fired on EMG. The hip thrust won those rankings, and many people took that as proof that it builds the most glute. But nobody had actually measured the muscle growing.

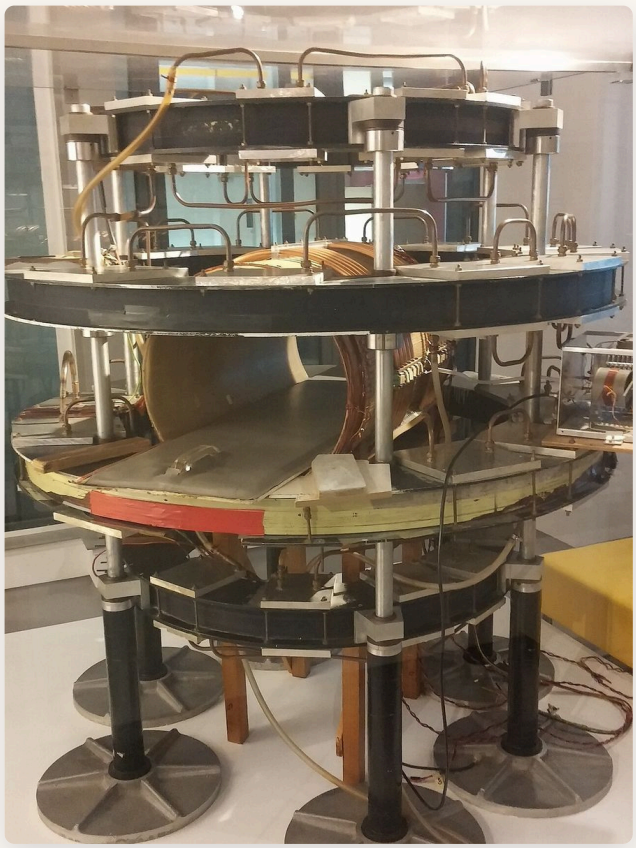
This final chapter is about the moment the field started to measure the thing it cared about: muscle size, seen on a scan, before and after weeks of training. The answers were not what most people expected.

PART 1 · THE OLD WAY

## Ranking by signal

In 2015, Bret Contreras and colleagues tested thirteen trained women. In the upper glute max, the hip thrust gave a mean signal of 69.5 percent of maximum. The back squat gave 29.4 percent. Many people took that as proof that hip thrusts build more glute.

But the paper itself did not say that. It asked for training studies to find out. In 2018, Andrew Vigotsky and colleagues explained why. The size of the signal depends on many things besides how hard a muscle works, and predicting growth from it is often not supported. Someone had to measure the muscle itself.



**Mark One.** An early whole-body MRI scanner built in Aberdeen around 1980, now on display at Aberdeen Royal Infirmary.

Photograph by AndyGaskell. CC BY-SA 4.0




**A modern MRI scanner.** Scans like this can measure the volume of a single muscle before and after training.

Photograph by Jan Ainali. CC BY 3.0

HOW THEY MEASURE GROWTH

**MRI** takes many thin slices of the body and adds them up into a muscle volume. **Ultrasound** measures how thick a muscle is at a few points. MRI is the gold standard. Ultrasound is cheaper and quicker. Numbers from the two methods should not be compared directly.

PART 2 · THE FIRST SCAN

# Squat depth, 2019

In 2019, in Tokyo, Keitaro Kubo's team trained seventeen men for ten weeks. One group did full squats. The other did half squats. MRI measured the muscles before and after.

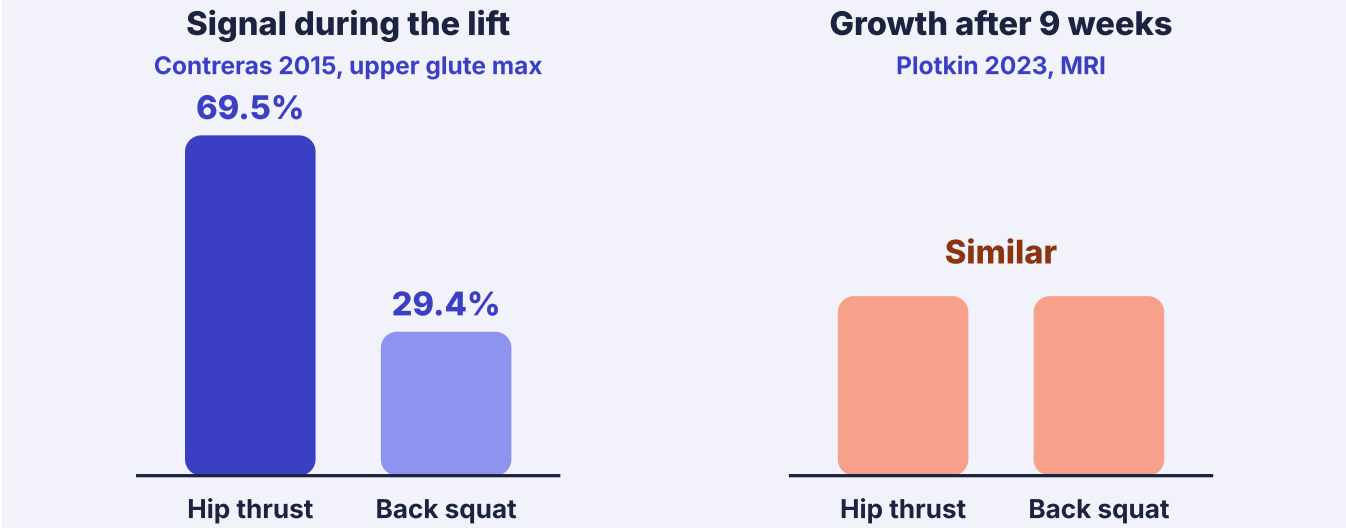



The squat, often written off as a quad exercise, grew the glutes. How deep you squatted decided how much.

PART 3 · HEAD TO HEAD

# Hip thrust against back squat, 2023

Then came the test people had argued about for years. In 2023, at Auburn University, Daniel Plotkin, Michael Roberts and colleagues had 34 untrained adults do either hip thrusts or back squats for nine weeks, with MRI before and after.




The big lesson of the proof era in one picture. A much bigger signal during the lift, but similar growth after weeks of training. Squats also grew the quads and adductors more. Drawn by Booty Center from the cited papers.

Glute growth was similar in both groups. The squat group also grew their quads and adductors more. The exercise with more than double the signal did not build more glute.

PART 4 · MORE SCANS

# Adding, pooling and a leg press surprise

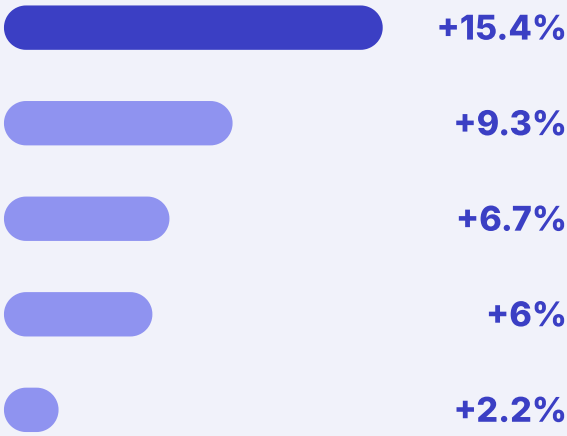
In 2024, in Brazil, Witalo Kassiano and colleagues trained 33 untrained young women for ten weeks. One group did the leg press and the stiff-leg deadlift. The other did the same, plus the barbell hip thrust. Measured with ultrasound, glute max thickness rose 9.3 percent with the hip thrust added and 6.0 percent without. So the hip thrust helped as an addition to a program.

In 2025, Walter Krause Neto and colleagues published the first pooled analysis of glute max growth. Only twelve studies qualified. Together they showed a moderate training effect, with deep squats, hip thrusts, the leg press and kneeling hip

extensions all growing the muscle.

And in 2026 came a surprise. In Japan, Sumiaki Maeo's group had seventeen untrained adults train one leg on the leg press and the other on the knee extension, for twelve weeks. The leg press leg gained 15.4 percent in glute max volume. The knee extension leg gained none.

### What has grown the glute max, measured




A list, not a ranking. These are different people, programs and measuring methods. Only numbers from the same study can be compared.

**2015**
Signal: hip thrust more than double the squat.

**2018**
Vigotsky: signal does not predict growth.

**2019** KEY
Kubo: deep squats grow the glutes.

**2023** KEY
Plotkin: hip thrust and squat, similar growth.

**2024**
Kassiano: adding the hip thrust helps.

**2025**
First pooled analysis.

**2026**
Leg press grows the glute max.

THE OLD BELIEF THIS CHAPTER TESTS

## "The exercise with the biggest signal builds the most muscle, and squats and leg presses are only for the quads."

**Not supported**

The whole field ran on the first idea for a decade. Then the scans came: the hip thrust had more than double the signal, yet the growth came out similar. And squats and the leg press grew the glute max in every scan that tested them.

PART 5 · STILL OPEN

# What we do not know yet

A lot is still open. Most of these studies used beginners, and they ran nine to twelve weeks. We know much less about trained lifters over months and years, about women and men separately, and about which part of the glutes grows with which exercise. The best answer in 2026 is a humble one: many exercises that load hip extension hard can grow the glutes, and how hard and how often you train them probably matters more than which one wins an EMG ranking.

**WHAT THIS MEANS FOR TRAINING TODAY**

Build your program on hard, progressive hip extension work, and do not chase signal rankings. Deep squats, hip thrusts, the leg press, deadlift variations and kneeling hip extensions have all grown the glute max in measured studies. Pick the ones you can train hard, safely and consistently, and give them time.

That is where this magazine ends, for now. Two hundred years after Cuvier guessed what our glutes are for, we can finally measure what makes them grow. The next chapters are being written in labs right now.




## Watch Chapter 8

The same story as a short animated film with voiceover, 3 minutes 30 seconds. Or play the interactive version and make your guess before the answer.

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## Sources


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