

XION

BORN TO RUN

REWIRE YOUR MOVEMENT SYSTEM

Dr. Junggi Hong



WHAT IS RUNNING?

A person with long hair, wearing a dark t-shirt and patterned shorts, is running away from the camera on a paved path. The background is a blurred natural setting with trees and grass. The overall image has a dark, high-contrast aesthetic.

- **Running** is a method of terrestrial locomotion allowing humans and other animals to move rapidly on foot.
- **Running** is a type of gait characterized by an aerial phase in which all feet are above the ground

WHY DID WE HAVE TO RUN?

A silhouette of a runner in a desert landscape. The runner is in the foreground, running on a paved road. The background shows a vast, hazy desert with rolling hills and mountains under a dark sky. The overall tone is dramatic and emphasizes the physical challenge of running in such an environment.

- The prey was too strong and dangerous for humans to hunt.
- Humans put together a team and used hunting strategies to keep the heavy and large animals moving in the hot weather.
- Humans cooled their heat by sweating or drinking water, but animals could not.
- Humans ran continuously so that animals could not cool off or rest.
- Humans ran about 40km at a time for hunting.
- Humans ran at least 2 to 7 hours when they were hunting.

9 REASONS HUMANS WERE BORN TO RUN

- 1) Short strong toes
- 2) The Windlass Mechanism
- 3) The Calf-Achilles Complex
- 4) Big, Powerful Glutes
- 5) Slow Twitch Muscle Fibers
- 6) Independent Breathing
- 7) Nuchal Ligament
- 8) Sweating & Hairless Bodies
- 9) The Runners high

9 REASONS HUMANS WERE BORN TO RUN

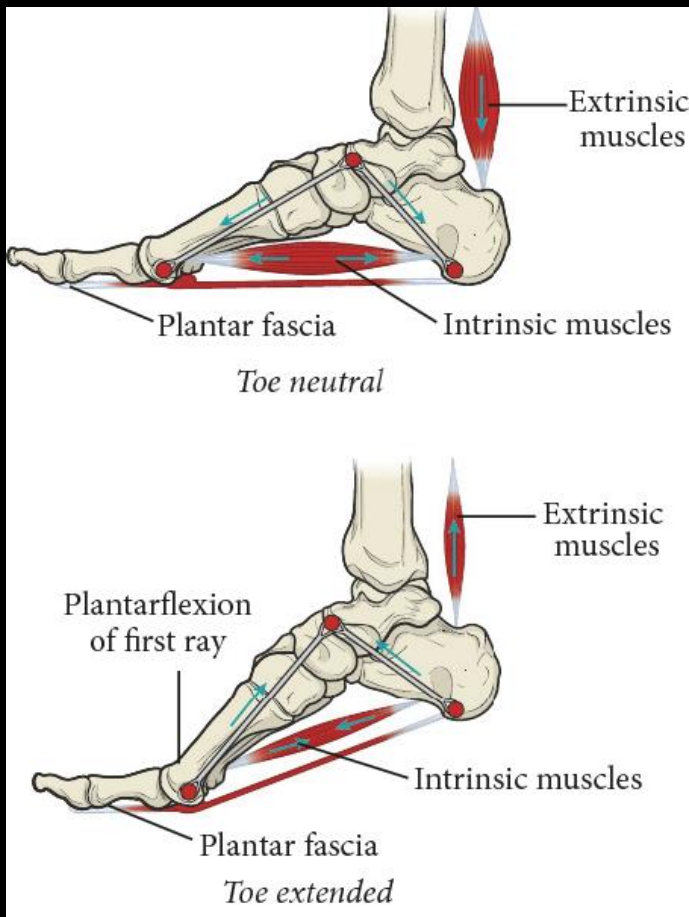
1) SHORT STRONG TOES



- Shorter toes create better leverage and allow us to generate incredible forces and push off the ground when running at high speeds as well as efficiency when running distances

9 REASONS HUMANS WERE BORN TO RUN

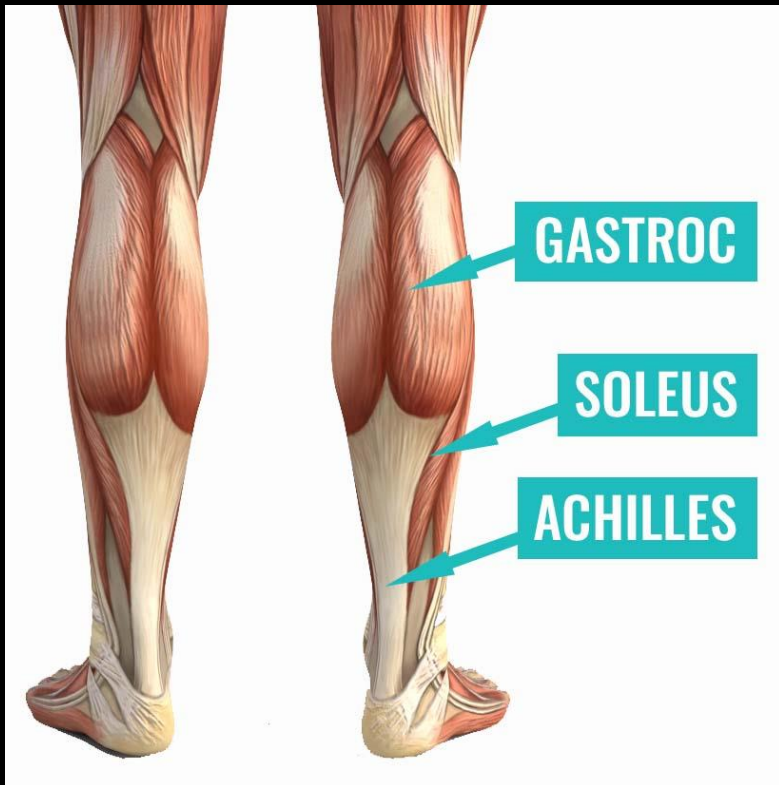
2) THE WINDLASS MECHANISM



- It pulls on the plantar fascia locking the arches of the foot into position helping to create a rigid stable foot.
- The foot can be both a rigid propulsion device and a flexible absorbing device switching back and forth in only fractions of a second during the gait cycle

9 REASONS HUMANS WERE BORN TO RUN

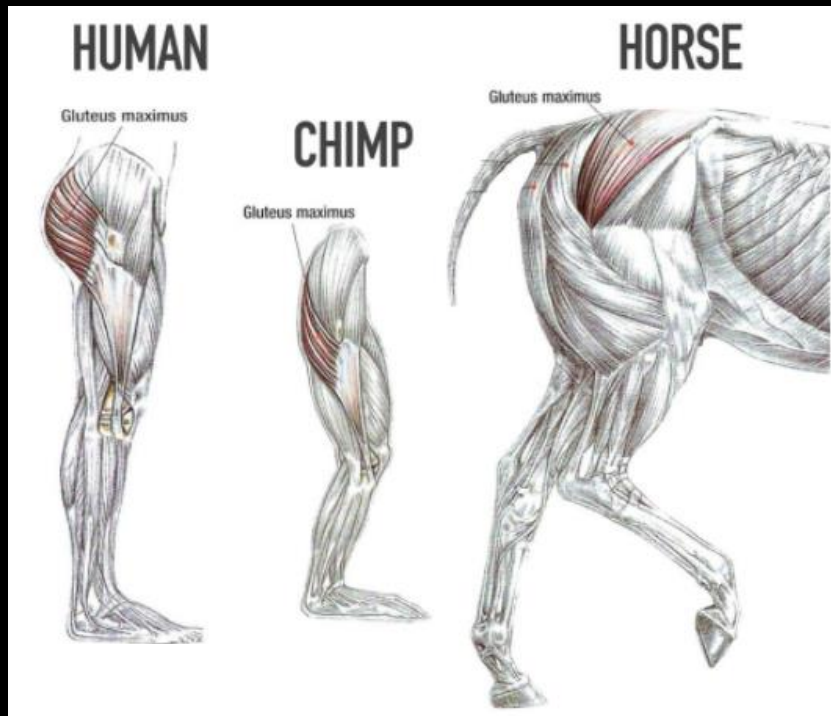
3) THE CALF-ACHILLES COMPLEX



- Strong and efficient calf muscle can work eccentrically to absorb the force of impact.
- The Achilles is the strongest, thickest tendon, It's built for high speed, high force and endurance.

9 REASONS HUMANS WERE BORN TO RUN

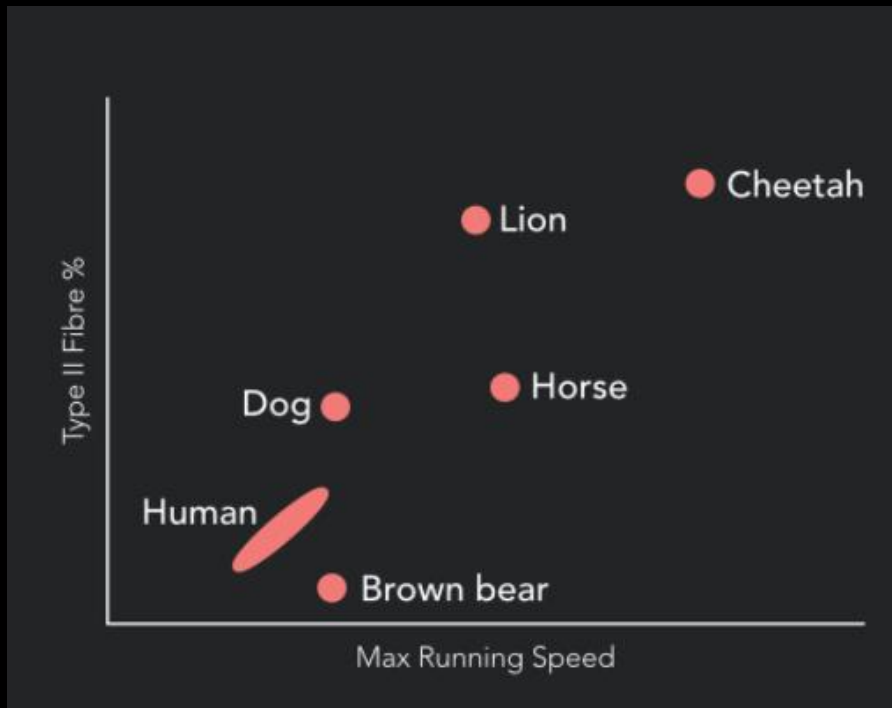
4) BIG, POWERFUL GLUTES



- Gluteus maximus is the biggest muscle and because of its position, it is suited perfectly to running more than any other activity.

9 REASONS HUMANS WERE BORN TO RUN

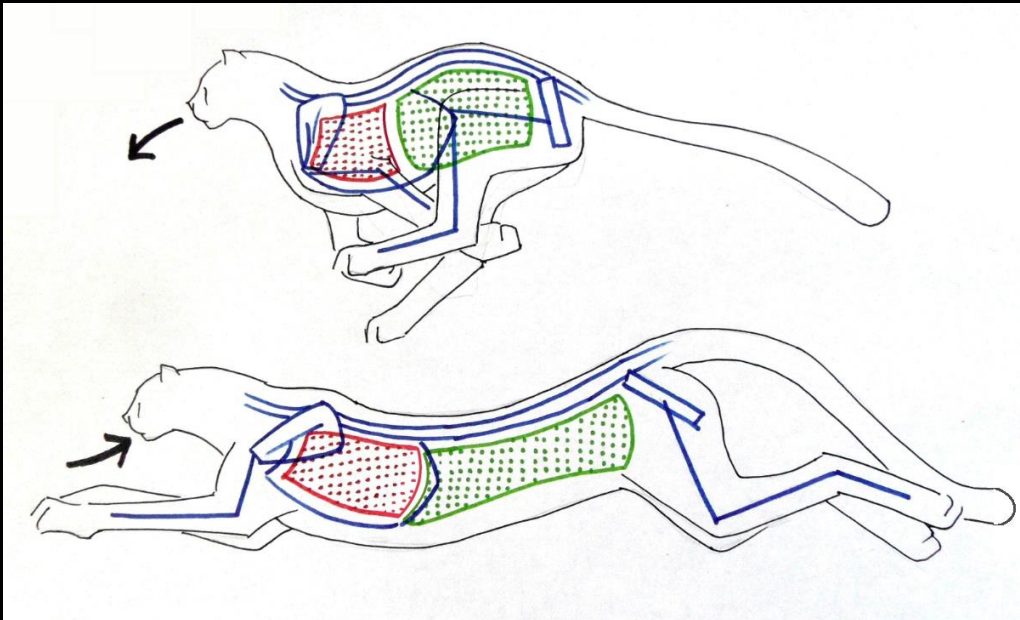
5) SLOW TWITCH MUSCLE FIBERS



- Compared to the rest of the large mammals, humans are on the slower end of the continuum. So humans hunted by chasing wild animals by grinding them into exhaustion over many hours.

9 REASONS HUMANS WERE BORN TO RUN

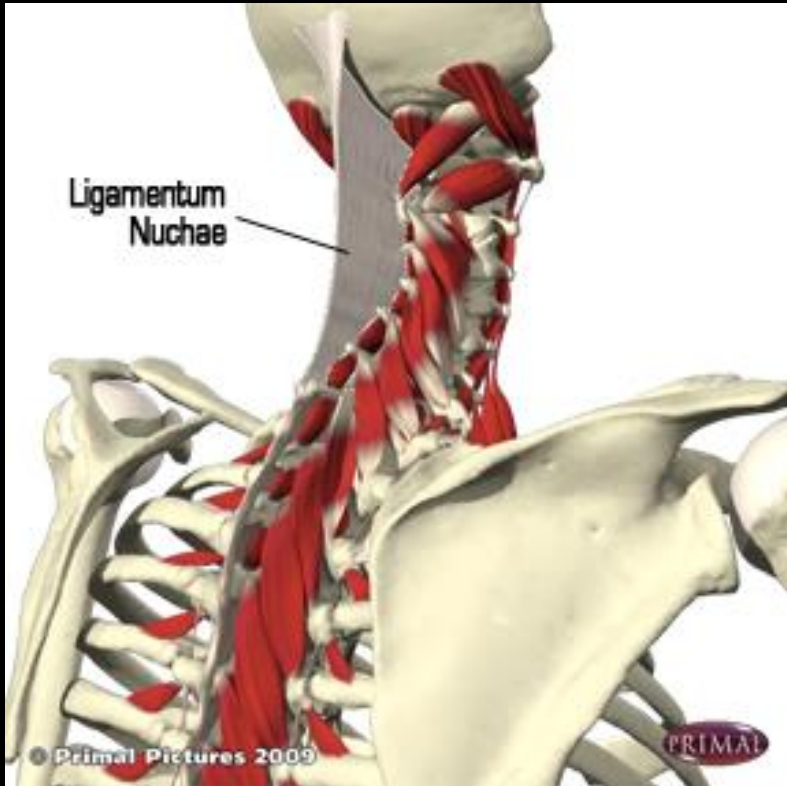
6) INDEPENDENT BREATHING



- When the Cheetah runs, it's whole body works like a pump stretching and compressing on the diaphragm and ribs pushing air in and out of the lung. This is a major part of the reason Cheetah have no stamina.
- Human can breathe at a rate completely independent to running speed, this allows us to maintain a steady oxygen intake without hyperventilation

9 REASONS HUMANS WERE BORN TO RUN

7)NUCHAL LIGAMENT



- This structure provides passive support and stability to the head and neck.
- humans are the only primates to have it

9 REASONS HUMANS WERE BORN TO RUN

8) SWEATING & HAIRLESS BODIES



- This ability to tightly control and regulate temperature through evaporative cooling directly from the skin gives humans a huge endurance advantage.

9 REASONS HUMANS WERE BORN TO RUN

9) THE RUNNERS HIGH



- A runner's high is a brief, deeply relaxing state of euphoria. It occurs after intense or lengthy exercise
- This positive vibe can be put down to endorphins. These hormones produce feelings of euphoria and reduce the feeling of pain

WHY DO WE RUN?

RUNNING

REDUCES THE RISK OF:

Heart disease

High blood pressure

Cancer

Respiratory disease

High cholesterol

Type 2 diabetes

Disability

IMPROVES:

Postural balance

Heart function

Aerobic fitness

Adiposity status

Metabolic fitness



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Review

Is running associated with a lower risk of all-cause, cardiovascular and cancer mortality, and is the more the better? A systematic review and meta-analysis

Zeljko Pedisic,¹ Nipun Shrestha,¹ Stephanie Kovalchik,¹ Emmanuel Stamatakis,^{2,3} Nucharapon Liangruenrom,^{1,4} Jozo Grgic,^{1,4} Sylvia Titze,⁵ Stuart JH Biddle,⁶ Adrian E Bauman,³ Pekka Oja⁷

ABSTRACT

Objective To investigate the association of running participation and the dose of running with the risk of all-cause, cardiovascular and cancer mortality.

Design Systematic review and meta-analysis.

Data sources Journal articles, conference papers and doctoral theses indexed in Academic Search Ultimate, CINAHL, Health Source: Nursing/Academic Edition, MasterFILE Complete, Networked Digital Library of Theses and Dissertations, Open Access Theses and Dissertations, PsycINFO, PubMed/MEDLINE, Scopus, SPORTDiscus and Web of Science.

Eligibility criteria for selecting studies Prospective cohort studies on the association between running or jogging participation and the risk of all-cause, cardiovascular and/or cancer mortality in a non-clinical population of adults were included.

Results Fourteen studies from six prospective cohorts with a pooled sample of 232 149 participants were included. In total, 25 951 deaths were recorded during 5.5–35 year follow-ups. Our meta-analysis showed that running participation is associated with 27%, 30% and 23% lower risk of all-cause (pooled adjusted hazard ratio (HR)=0.73; 95% confidence interval (CI) 0.68 to 0.79), cardiovascular (HR=0.70; 95% CI 0.49 to 0.98) and cancer (HR=0.77; 95% CI 0.68 to 0.87) mortality, respectively, compared with no running. A meta-regression analysis showed no significant dose–response trends for weekly frequency, weekly duration, pace and the total volume of running.

Conclusion Increased rates of participation in running, regardless of its dose, would probably lead to substantial improvements in population health and longevity. Any amount of running, even just once a week, is better than no running, but higher doses of running may not necessarily be associated with greater mortality benefits.

INTRODUCTION

Global and national public health authorities recommend that adults take part in 150 min of moderate to vigorous physical activity (MVPA) each week.^{1–3} The epidemiological literature strongly supports the beneficial associations of the total amount of MVPA with health outcomes.^{4–10} Several systematic reviews and meta-analyses have summarised the evidence for the association between MVPA and the risk of disease-specific and all-cause mortality.^{11–16} For example, one meta-analysis found that insufficient MVPA (defined as not meeting the current

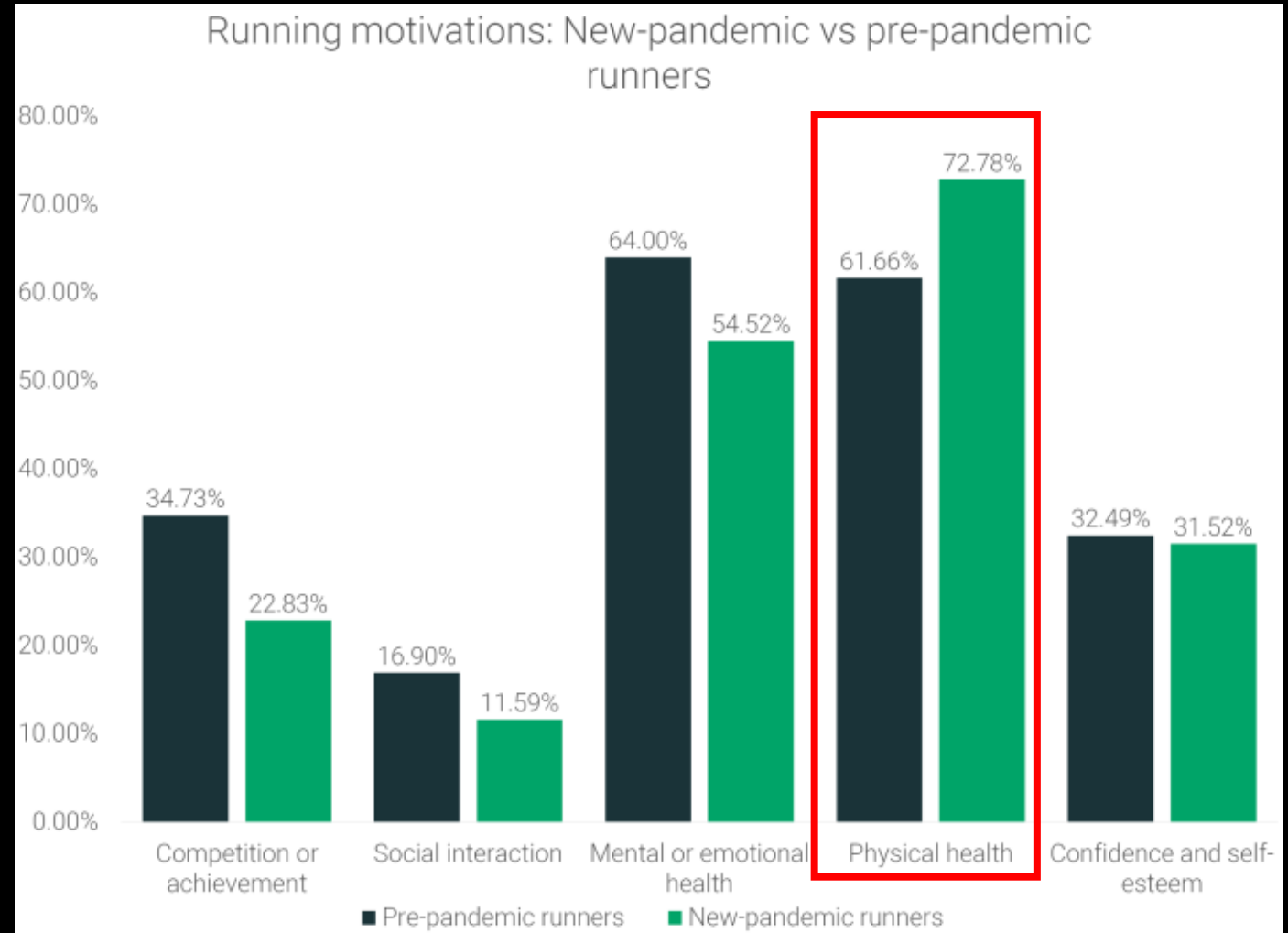
World Health Organization (WHO) guidelines for MVPA¹) is associated with a 28% higher risk of all-cause mortality, compared with sufficient MVPA.¹⁵ Considering the high levels of physical inactivity globally, Lee and colleagues estimated that more than 5 million premature deaths a year would be prevented if physically inactive people became sufficiently active.¹⁵ Considerable interest has also been shown in the effects of different types of physical activity (eg, walking, cycling, running, swimming) on health and risk of premature mortality.^{17–24} In other words, for a given amount of MVPA, does the type of physical activity matter?

Running is among the most popular types of physical activity. It has been estimated that each month around 3.7 million (8.5%) English adults take part in running as a sport or recreational activity.²⁵ Other countries, such as Australia²⁶ and the USA,²⁷ also have high participation rates. The 2017 Physical Activity Council's survey ranked running in the top 10 preferred activities in which inactive 25–44-year-old US adults wished to take part.²⁸ Given its popularity, running has great potential for improving population health. The Royal College of General Practitioners (RCGP) has acknowledged this potential by partnering with the *parkrun* UK initiative, to promote the uptake of running and walking among general practitioners and their patients.²⁹

In a systematic review, Oja *et al*¹⁷ concluded that the evidence for health benefits is scarce for participation in all sports except for running and football. The authors concluded that there is (i) moderate evidence for the associations between running and improved aerobic fitness, cardiovascular function and running performance; (ii) limited evidence for associations of running with improvements in metabolic fitness, adiposity status and postural balance; and (iii) inconclusive evidence for the associations of running with cardiac adaptation, muscular strength and disease-specific and all-cause mortality.¹⁷ Oja *et al*¹⁷ identified only one study on running participation and the risk of mortality. A subsequent, comprehensive narrative review summarised the evidence for the association of running and a range of health outcomes, including major cardiometabolic outcomes, bone and respiratory health, disability and disease-specific and all-cause mortality.²² The strength of the association between running participation and the risk of all-cause and disease-specific mortality varied

COVID-19 LED TO RUNNING BOOM

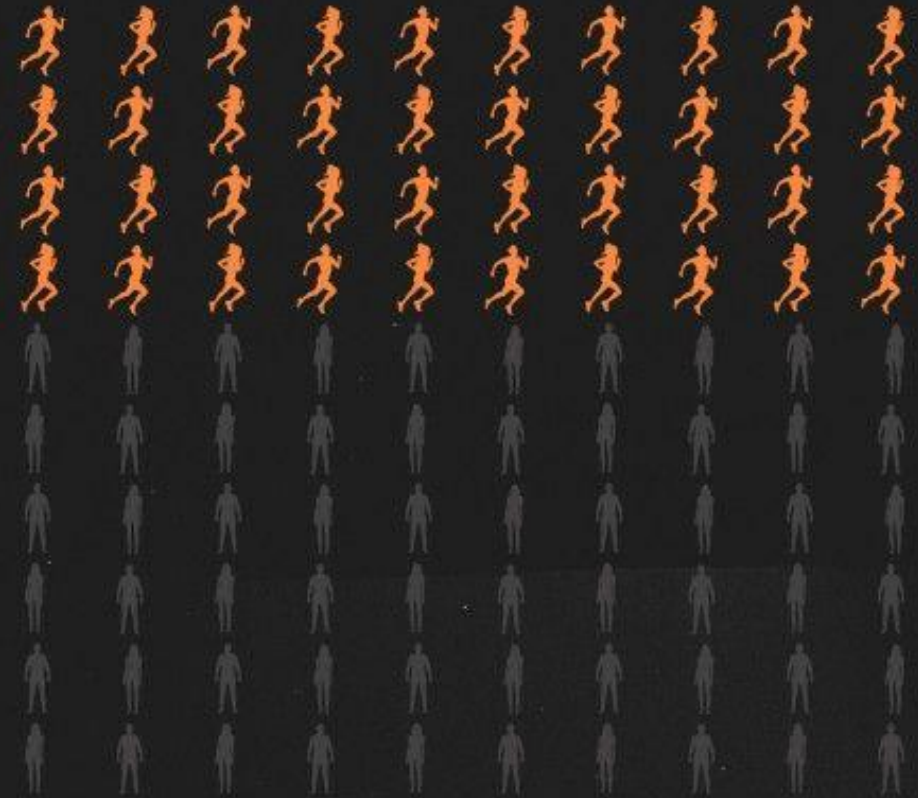
Running Boom:
28.76% of runners
started during the
pandemic



COVID-19 LED TO RUNNING BOOM



4 IN 10 PEOPLE CONSIDER THEMSELVES TO BE
RUNNERS ACROSS 10 MARKETS



- Data is based on 8414 interviews collected across 10 countries:
 - Australia, Colombia, France, India, Japan, Kenya, Mexico, South Africa, UK, USA
- Data collected between 26th March – 15th April 2021

PASSIVE LIFESTYLE

Nº01



8 HOURS/DAY

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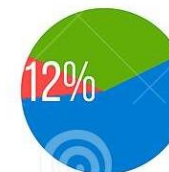
| Sedentary work |

Nº02



2 HOURS/DAY

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| Transportation trip |

Nº03



3 HOURS/DAY

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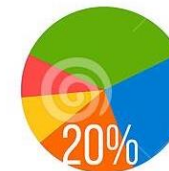
| Eating |

Nº04



4 HOURS/DAY

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| Passive rest |



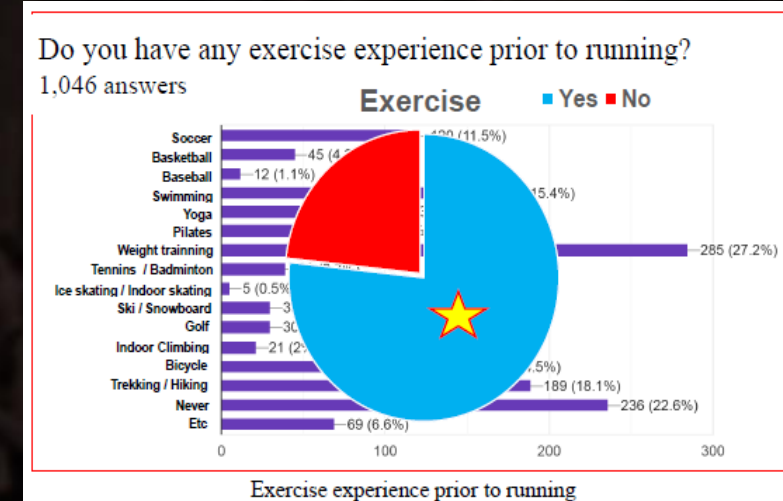
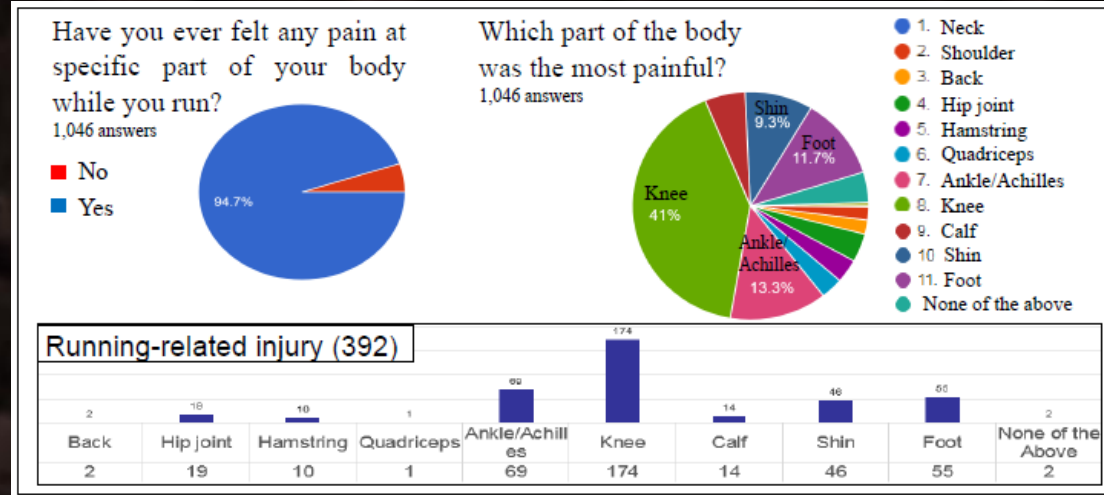
Epidemiology of running-related injuries in the Korean population: a cross-sectional survey of 1046 runners



Hye Chang Rhim¹, Sung Jong Kim¹, Jin Sung Jeon¹, Hyuk Woo Nam², Ki-Mo Jang^{1,3}

1. Korea University College of Medicine 2. Nam's Orthopedic Clinic 3. Department of Orthopedic Surgery, Korea University Anam Hospital

RISK OF INJURY IN RUNNERS



- 94.7% of runners experienced some kind of pain while running. 61% of runners experienced pain in the same area more than once.
- Increase in mileage from 20-30 km to 30-40 km was associated with running related injury.
- Runners should be careful in increasing weekly mileage. Moreover, runners with previous exercise experience may need to approach running more cautiously.

WHAT DOES IT MEAN TO US?

It takes time for your body to increase running distance.

Previous exercise experience does not mean that you are ready to run.

**PREPARE YOUR BODY
TO RUN FIRST!**

COMMON INJURIES

Overuse injuries slow runners down

As runners put more miles on their bodies, they need to allow time to let their muscles and bones restore themselves. If not, the bones and tissues can break down or become injured.

Stress fractures

One of the most common running injuries. The constant stresses of running breaks the bones down. The most common stress fractures for runners are in the metatarsal bones in the foot and the tibia and femur. Stress fractures in the hip are more common in women.

Back pain

The shock waves from a runner's feet pounding the road can be transferred up the legs to the back, where it can cause muscle strain and pain.

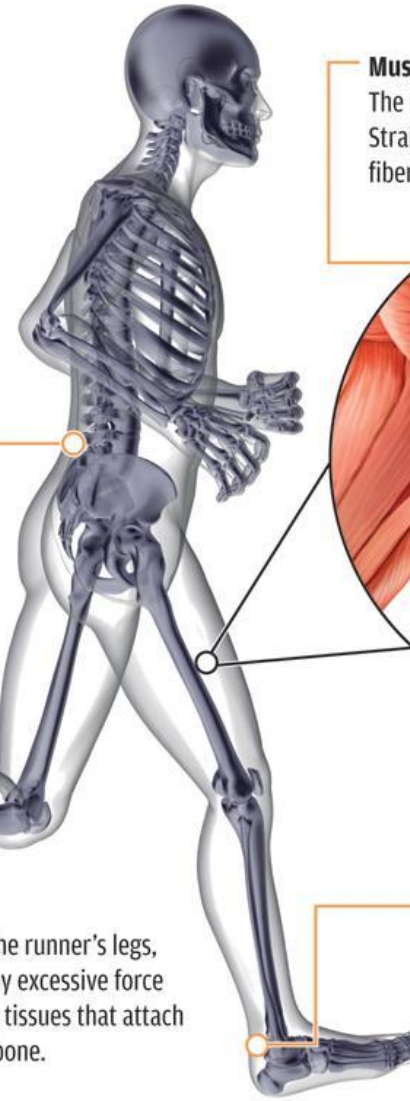


Plantar fasciitis

Inflammation of the thick tissue that connects the heel to the toes and creates the arch of the foot. This pain is usually felt in or under the heel.

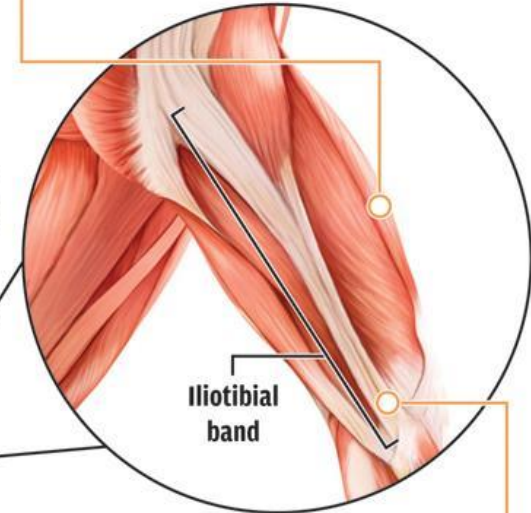
Shin splints

Usually felt inside the runner's legs, splints are caused by excessive force on the tibia and the tissues that attach the muscles to the bone.



Muscle strain to the quads and hamstrings

The most common muscle strains in runners. Strains or pulls involve tears to the muscle fibers or tendons.



Iliotibial band

Iliotibial band syndrome

This injury in the thigh usually feels like a pain just above the knee.

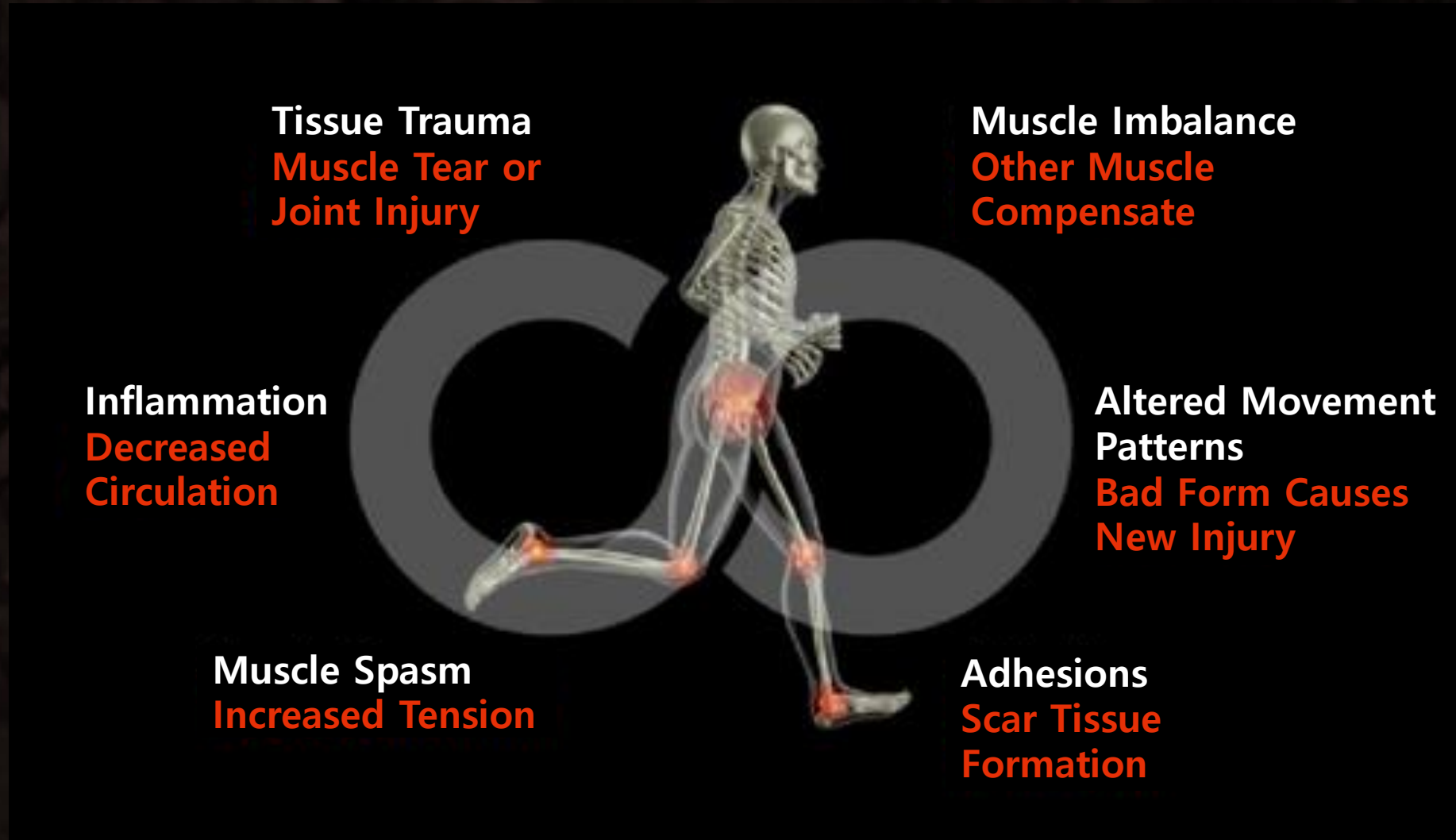
Achilles tendinitis

An inflammation of the large tendon in the back of the ankle. Symptoms include tenderness or stiffness above the heel, especially in the morning.

Sources: Nigel Sparks, assistant professor at the University of Florida's Bone and Joint Center on Emerson; Daniel Montero, Mayo Clinic sports medicine physician; Gate River Run race officials; U.S. National Library of Medicine; MayoClinic.com
Illustrations source: Photos.com

Reporting by David.Johnson@jacksonville.com
Graphic by Kyle.Bentle@jacksonville.com

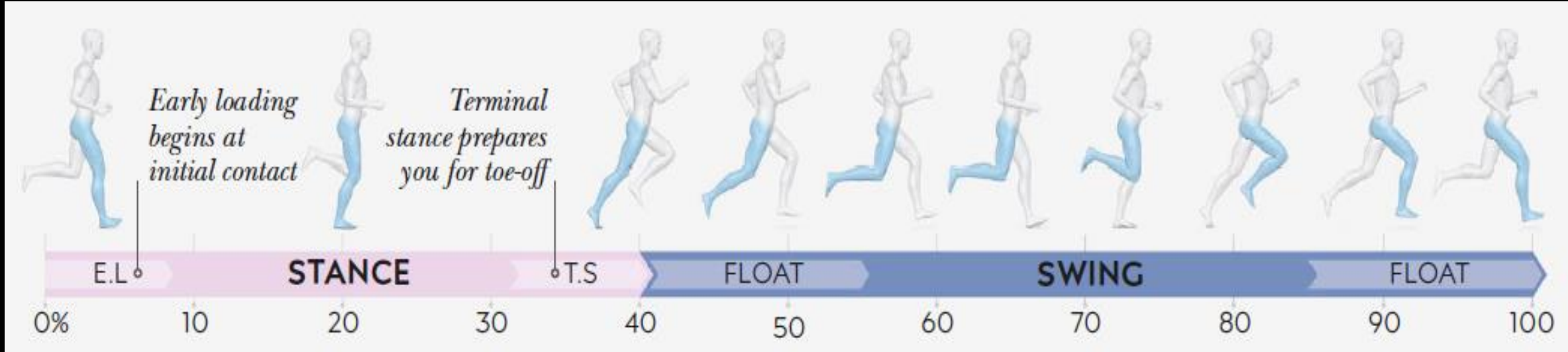
CUMULATIVE INJURY CYCLE



BREAK TIME

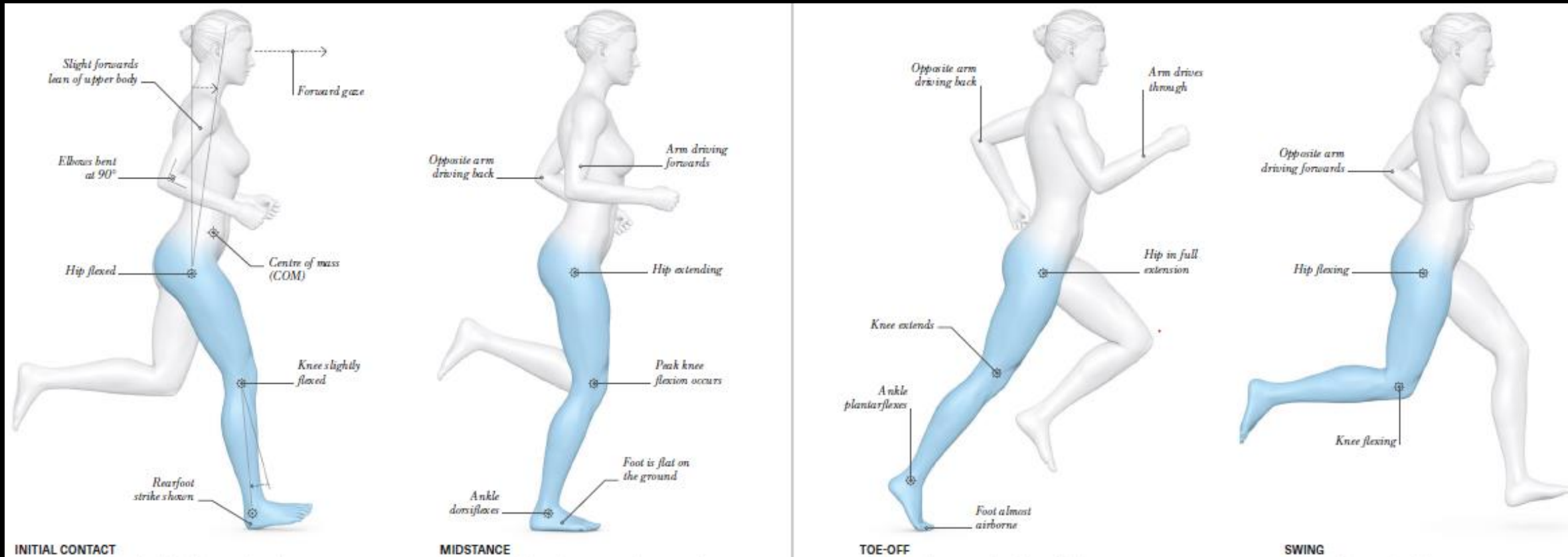
RUNNING CYCLE

STANCE PHASE (40%), SWING PHASE (60%)

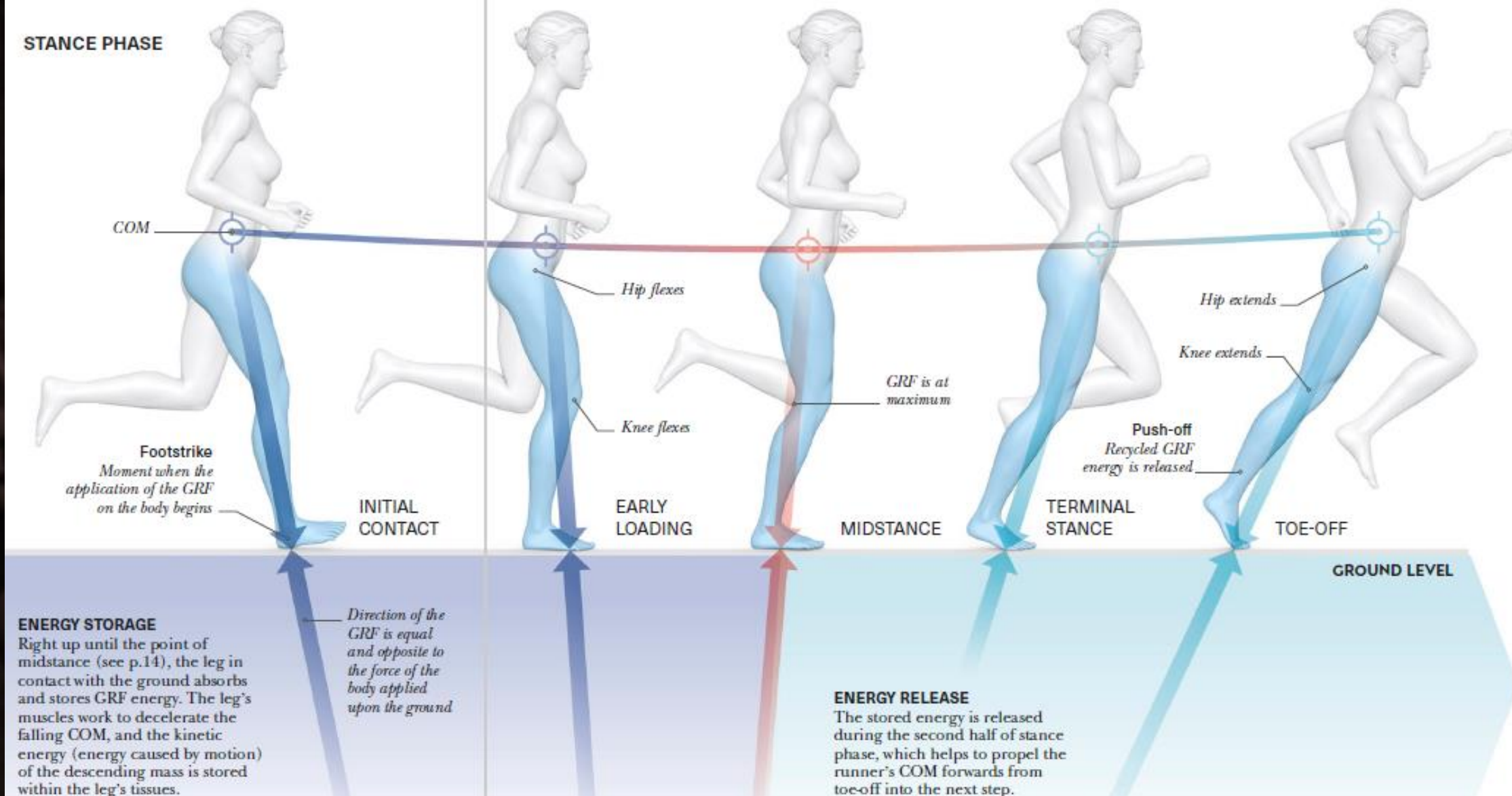


RUNNING CYCLE

STANCE PHASE AND SWING PHASE



STANCE PHASE



Footstrike
Moment when the application of the GRF on the body begins

INITIAL CONTACT

EARLY LOADING

MIDSTANCE

TERMINAL STANCE

TOE-OFF

GROUND LEVEL

ENERGY STORAGE

Right up until the point of midstance (see p.14), the leg in contact with the ground absorbs and stores GRF energy. The leg's muscles work to decelerate the falling COM, and the kinetic energy (energy caused by motion) of the descending mass is stored within the leg's tissues.

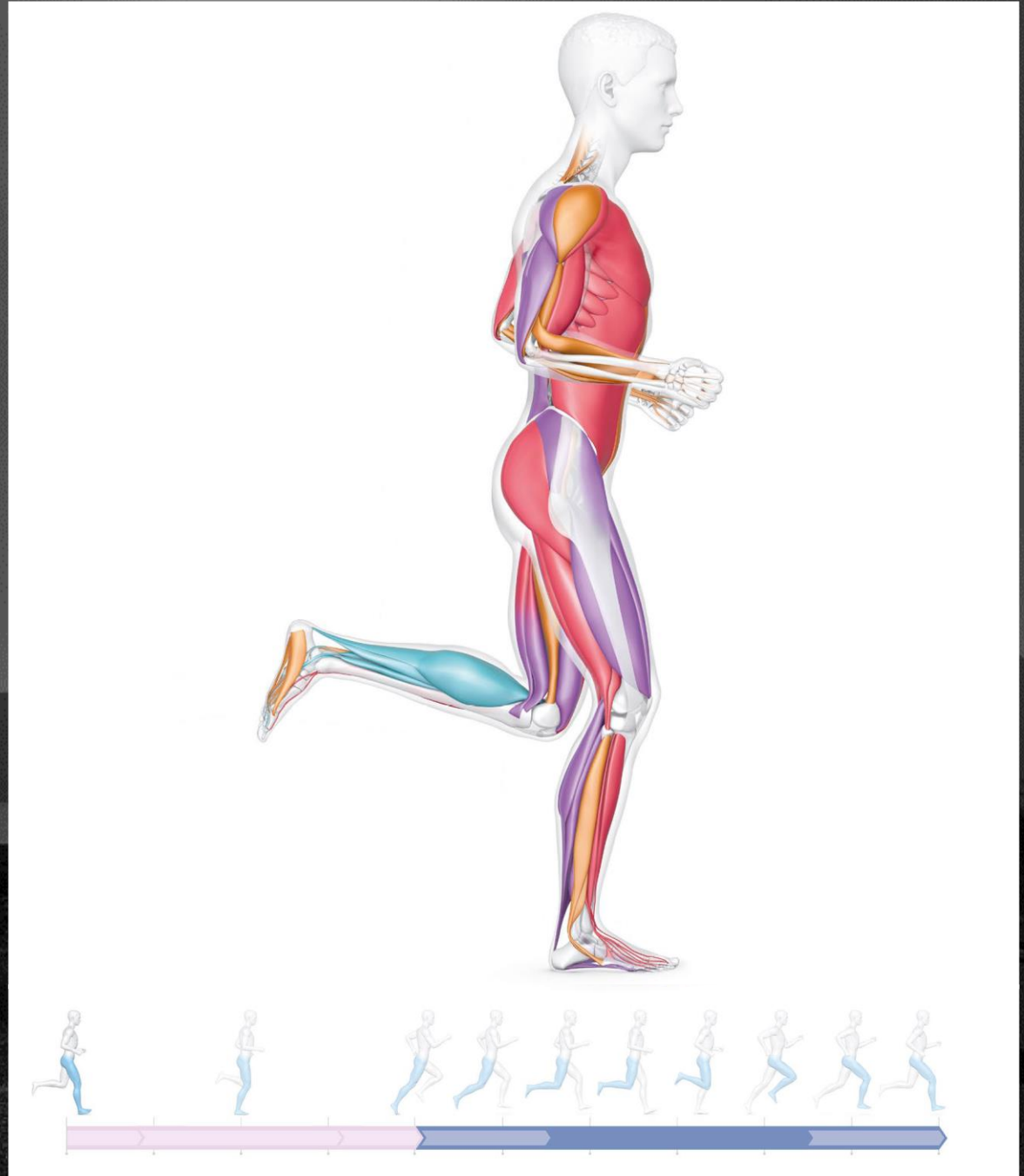
Direction of the GRF is equal and opposite to the force of the body applied upon the ground

ENERGY RELEASE

The stored energy is released during the second half of stance phase, which helps to propel the runner's COM forwards from toe-off into the next step.

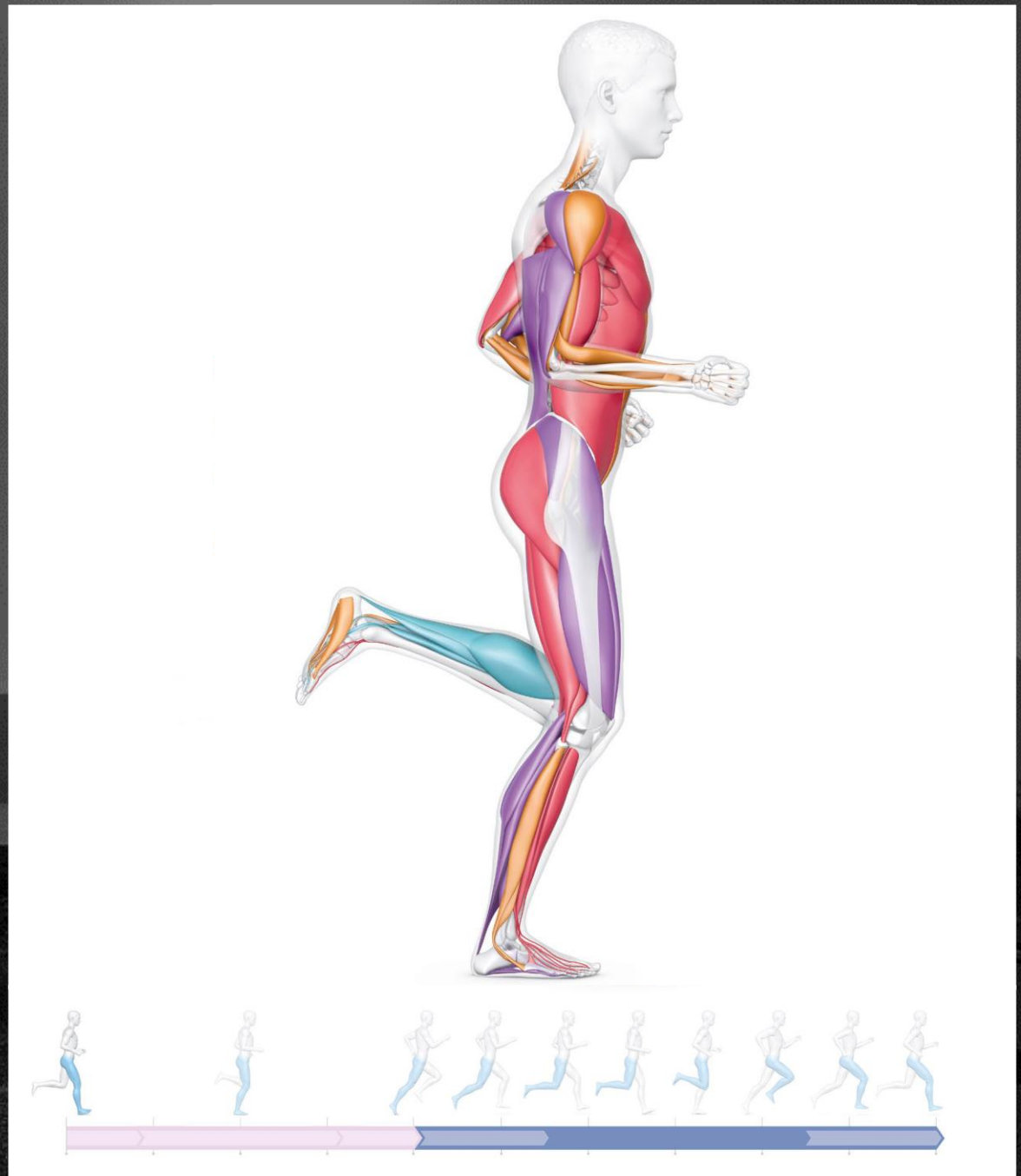
EARLY LOADING PHASE

As the leading foot makes initial contact with the ground, the body decelerates in the vertical direction and significant muscle contributions are needed to control and attenuate the ground reaction force (GRF). As the foot flattens, tendons and connective tissues within muscles store elastic energy to be used later for propulsion.



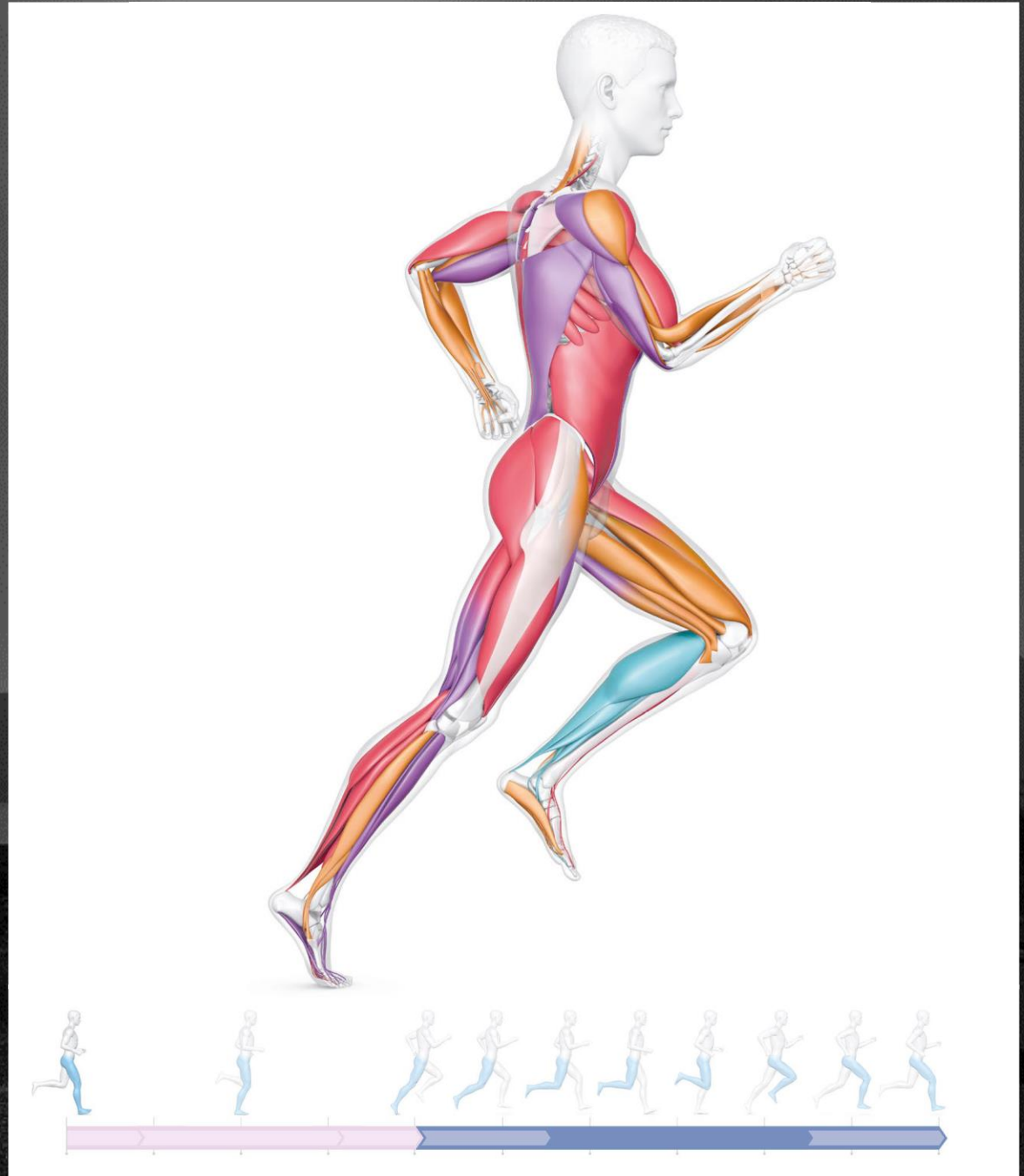
MIDSTANCE PHASE

In midstance, the body transitions from absorbing GRF to releasing recycled GRF energy. As the body passes over the top of the supporting leg, it must be dynamically stabilized to cope with maximal loading through the limb.



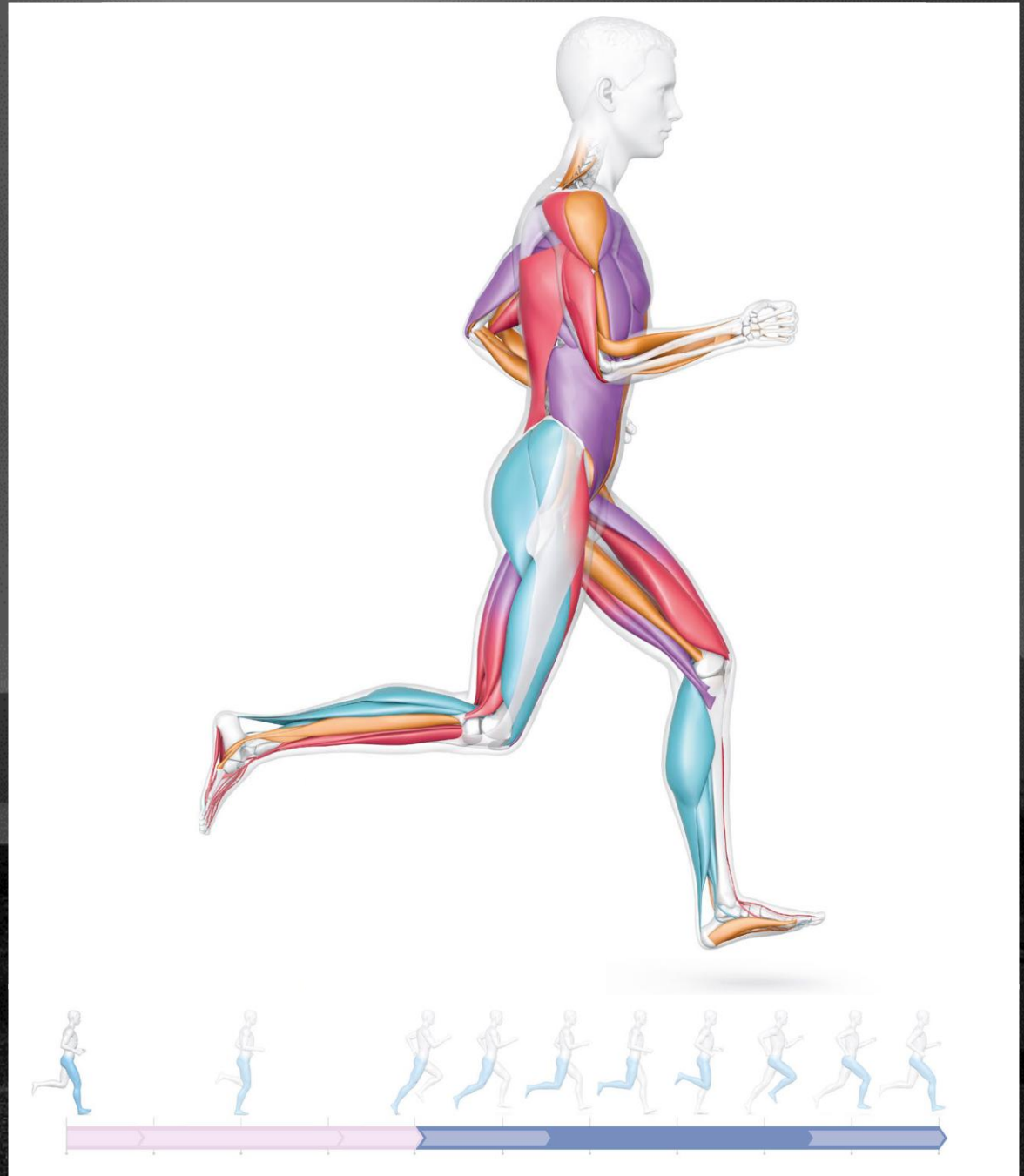
TERMINAL STANCE PHASE

This final sub-phase culminates in toe-off, when the hip, knee, and ankle are in maximal extension to propel the body forwards. Immediately after toe-off, the hip and knee begin to move into flexion and the ankle starts to dorsiflex, preparing for the swing phase.



SWING PHASE

Comprising approximately 60 per cent of the running cycle, swing phase is when the hip flexes rapidly to swing the leg through until it recovers its starting position, ready to power another step. During late swing, the knee begins to extend and prepare again for stance.

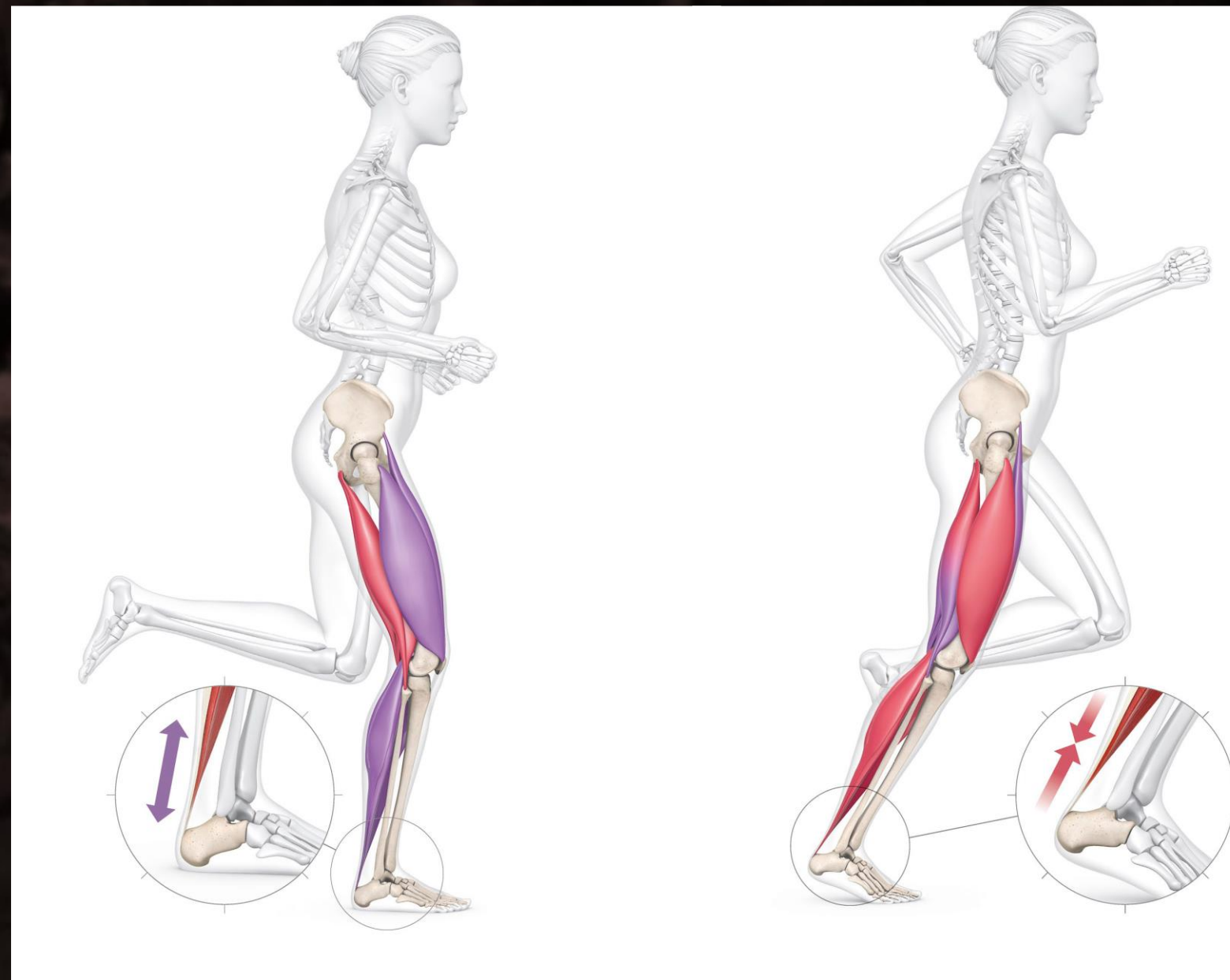


3 MAIN PARAMETERS OF RUNNING

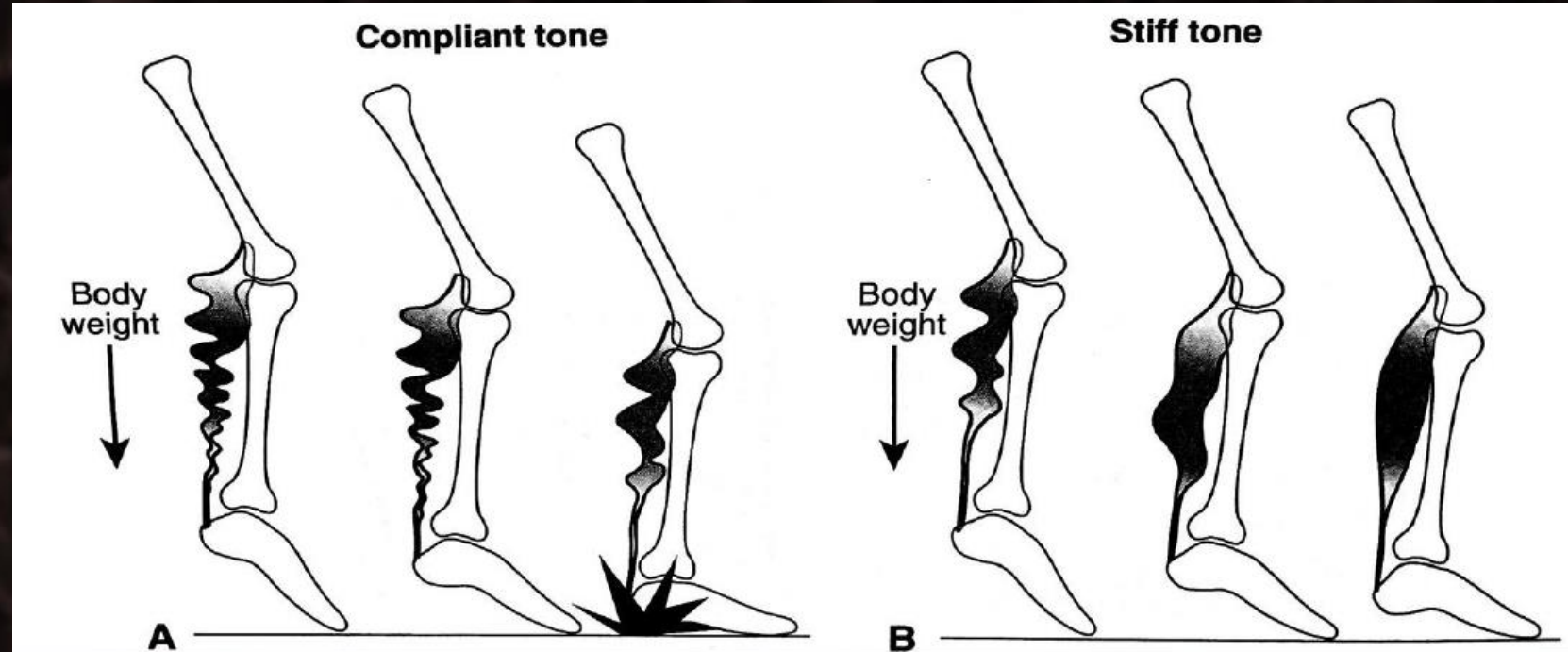
- Running Speed
- Running Cadence
- Running Step length
(Not Running Stride length)



MUSCLE AND TENDON ACTION



MUSCLE AND TENDON ACTION



MUSCLE TENDON ACTION AND MOVEMENT PATTERNS



Making muscles smarter
improves the foundation

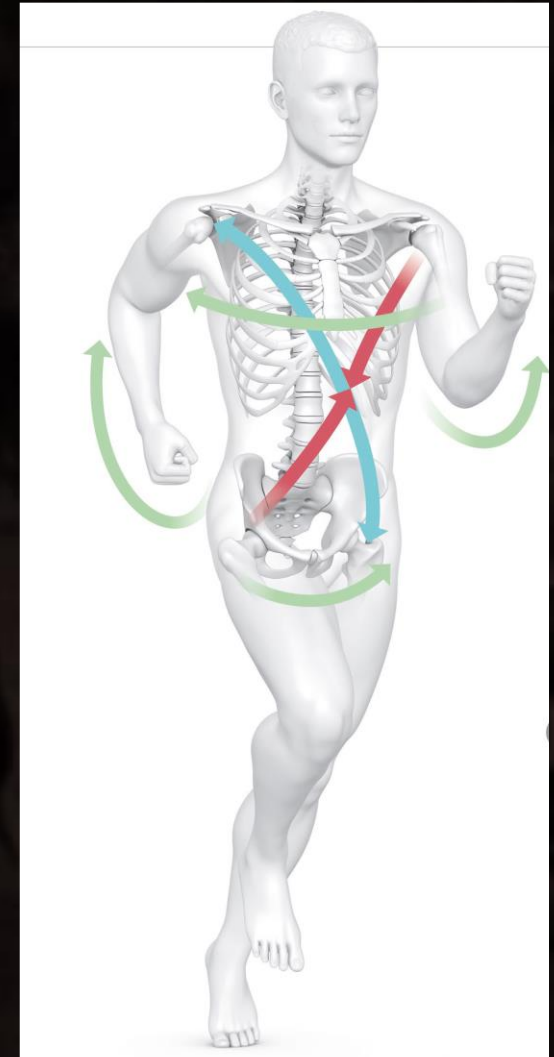


Improving strength and
speed improves stiffness

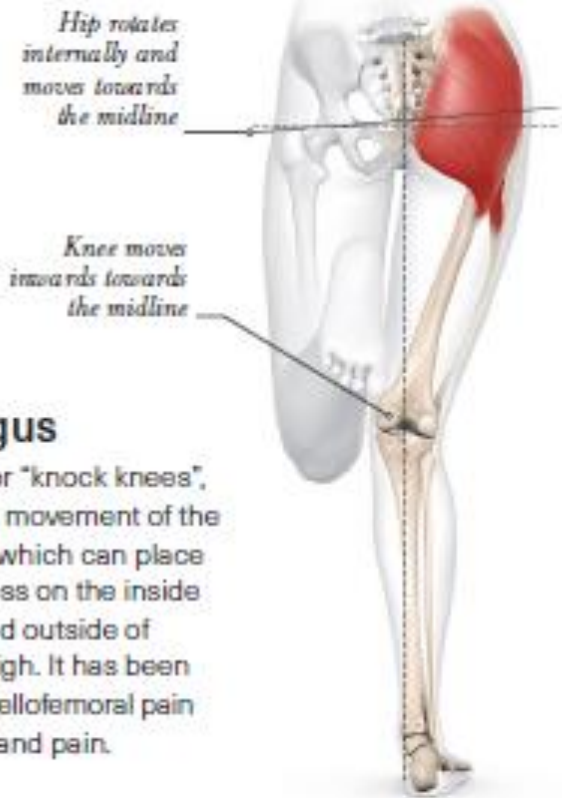


KINETIC CHAIN

Rotation through kinetic chain
Multiple counter-rotations
Diagonal elastic support

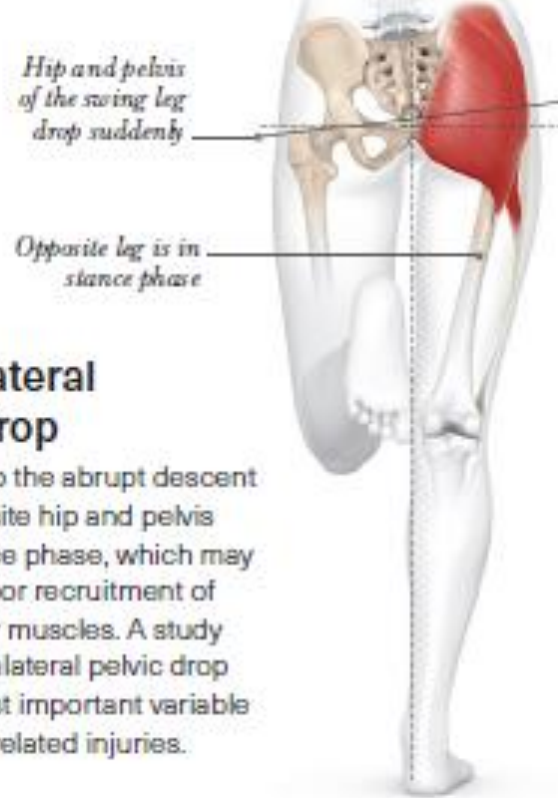


PELVIC, HIP, KNEE AND FOOT COMPLEX



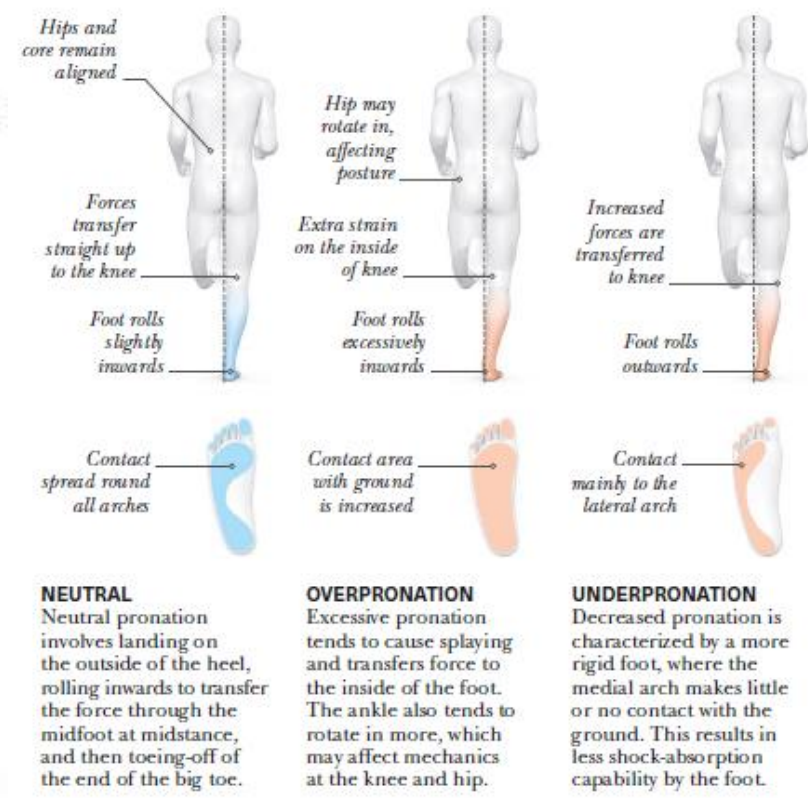
Knee valgus

Knee valgus, or "knock knees", is a combined movement of the hip and knee, which can place increased stress on the inside of the knee and outside of the hip and thigh. It has been linked with patellofemoral pain and iliotibial band pain.



Contralateral pelvic drop

This refers to the abrupt descent of the opposite hip and pelvis during stance phase, which may be due to poor recruitment of hip abductor muscles. A study found contralateral pelvic drop was the most important variable for running-related injuries.



FOOT STRIKE PATTERNS



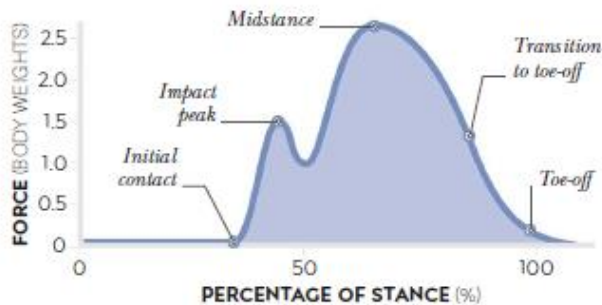
Rearfoot strike

Between 80 and 95 per cent of all distance runners are rearfoot strikers who land on the rear third of their foot at initial contact. This is linked with a more dorsiflexed ankle, where the toes turn upwards towards the shin. A rearfoot strike is associated with greater vertical loading rates.

Knee subjected to greater force

GRF passes behind the ankle joint

Reduced stress on foot, ankle, and calf muscles



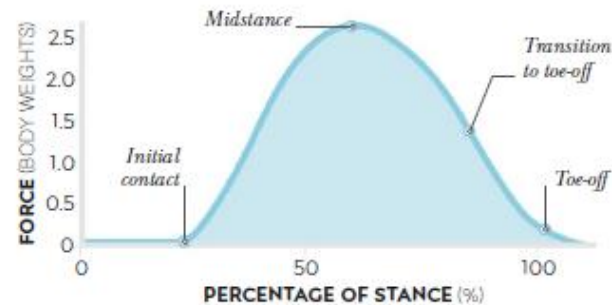
Forefoot strike

Forefoot striking is defined as landing on the front third of your foot at initial contact. This is associated with a plantarflexed ankle, where the toes point away from the shin. A forefoot strike pattern is believed to produce greater braking forces.

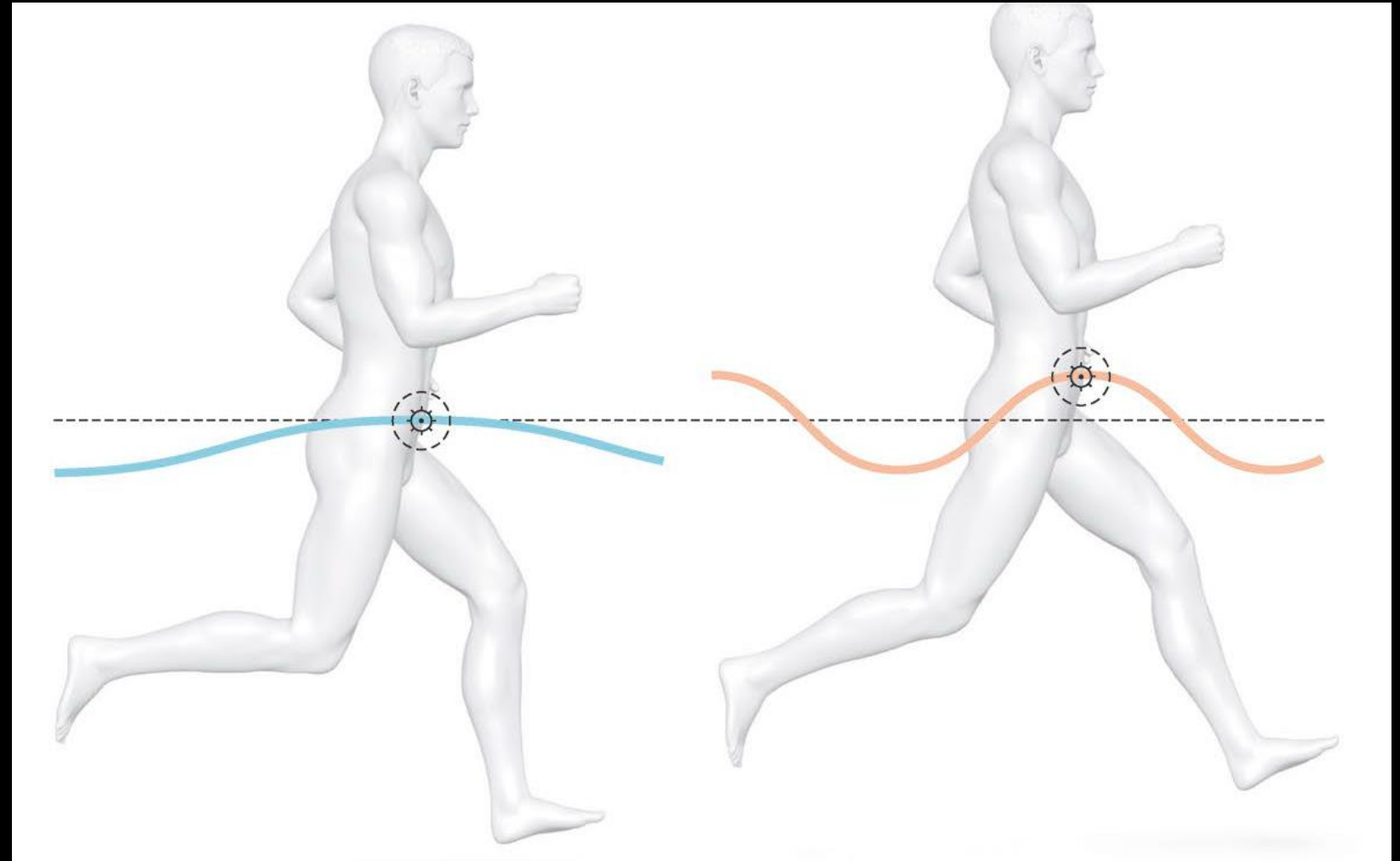
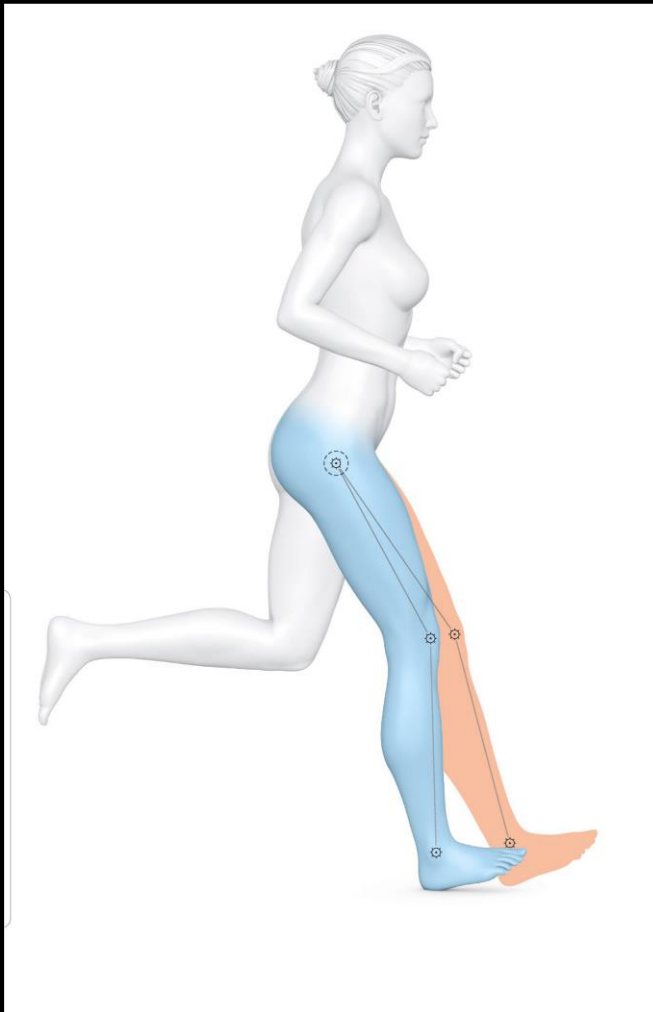
Forces at knee reduced

GRF passes in front of the ankle joint

Greater stress on foot, ankle, and calf muscles



STRIDE PATTERN: GOOD VS OVERSTRIDE



RE-WIRE REFLEXIVE MOVEMENT

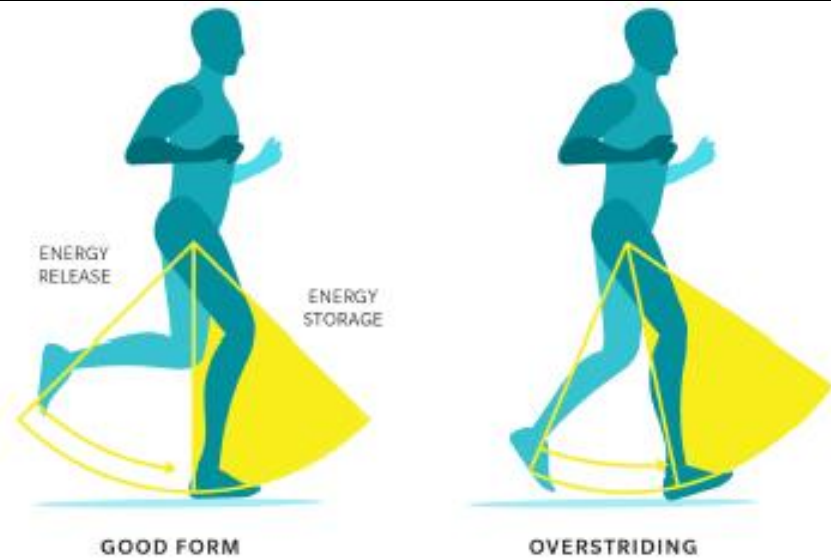


FIGURE 4.2: Pendulum shift

With good form, you encounter minimal stress-per-stride and optimal economy. When you make contact too far in front of the body, or overstride, it requires that you lift the body up and down more, overloading the muscles on the front side of the legs and increasing the stress-per-stride. A symmetric pendulum builds a successful stride.

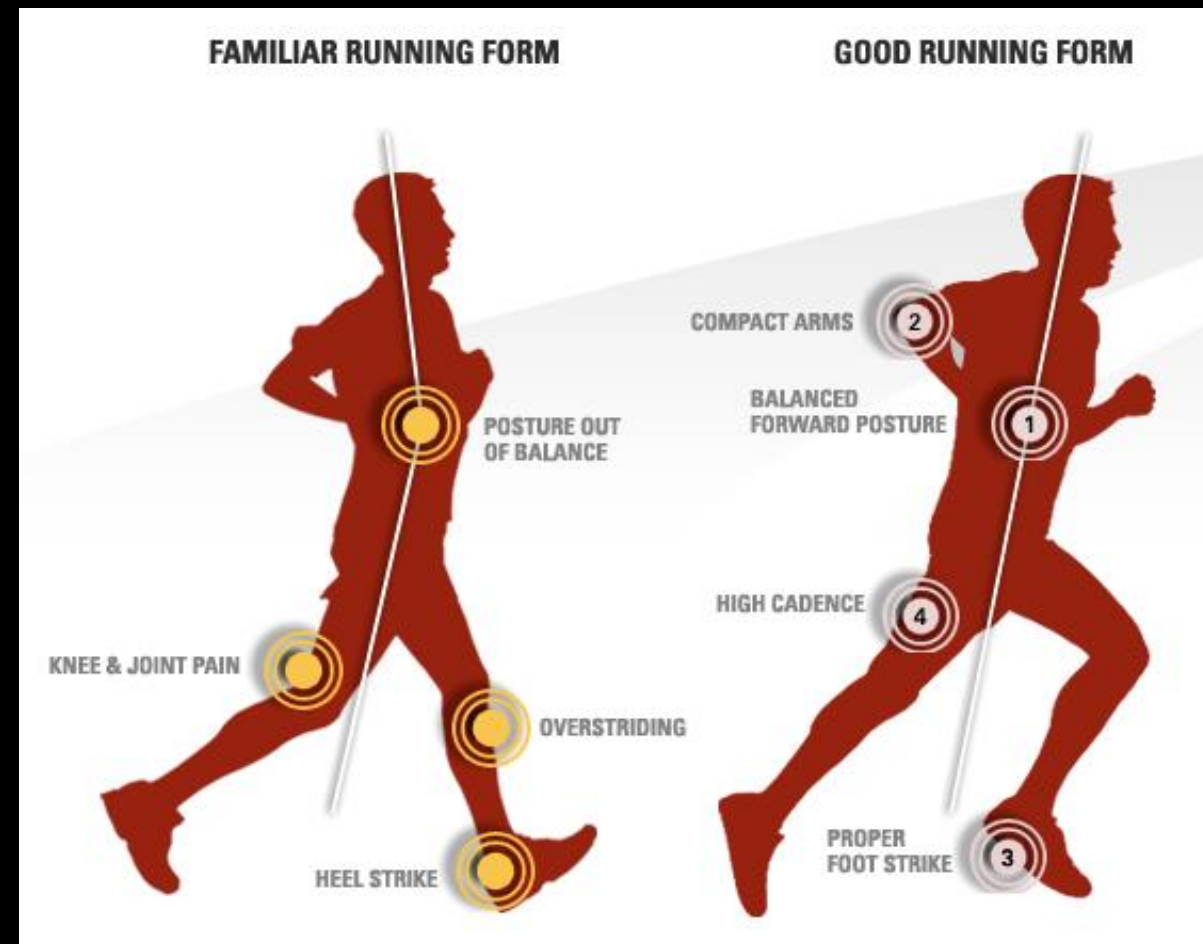
TABLE 4.1 Effects of Footstrike and Foot Placement

	Stress	Economy
If you overstride, landing on your heel	High stress because the foot makes contact too far in front of the body.	Extra work is required to lift the body up and down more, overloading the muscles on the front side of the legs.
If you run with a pendulum-like stride	Low stress, ideal load.	Optimal elastic recoil makes for more efficient running.
If you overstride, landing on your forefoot	Low stress because the ankle muscles are absorbing the load.	Ankle muscles work overtime to maintain forefoot position. Excessive acceleration and deceleration with each stride compromise efficiency.

RULE #1: MAINTAIN GOOD POSTURE

- Muscles, tendons, ligaments, and fascia are used more efficiently when the posture is correct.
- Proper posture makes you breathe better.
- The stepping position get better during running

< Bad posture >



RULE #1: MAINTAIN GOOD POSTURE



RULE #2: USE YOUR ARMS CORRECTLY

Why is it important to move your arms?

- Optimize the movement of lower limb
- Optimize the movement of the scapula
- Improve energy efficiency

< Bad posture >



RULE #2: USE YOUR ARMS CORRECTLY



RULE #3: USE YOUR LEGS EFFICIENTLY

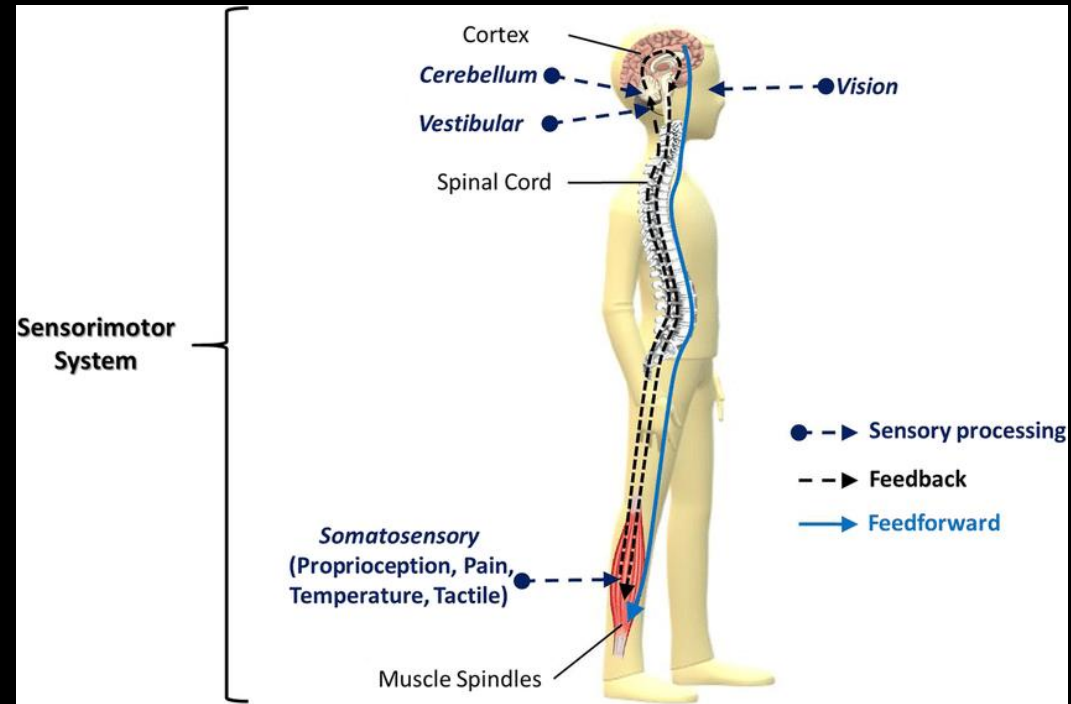
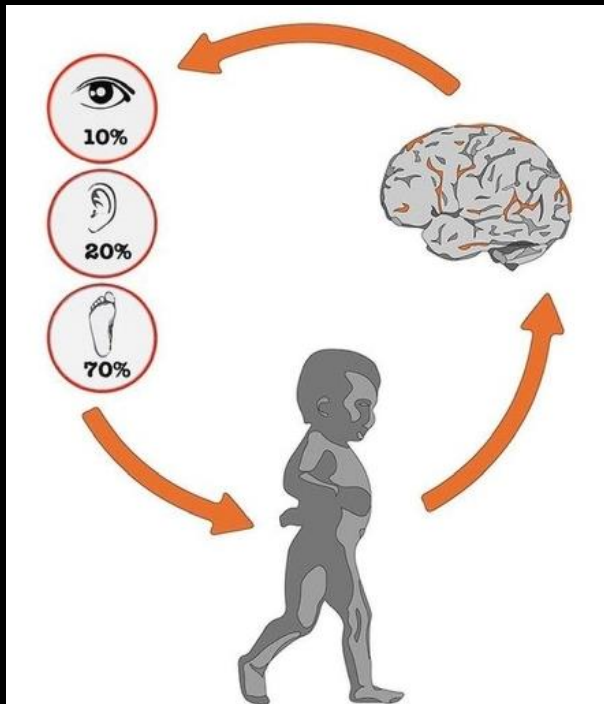
Why is leg movement important?

- When each joint moves organically together, elastic energy can be used more efficiently.
- To produce an optimized force vector
- Injury prevention

< Bad posture >



RULE #4: DEVELOP THE SENSES OF THE EYES AND FEET



- Muscles, tendons, ligaments, and fascia are used more efficiently when the posture is correct.
- Proper posture makes you breathe better.
- The stepping position get better during running

RULE #5: BREATHE EFFECTIVELY



- Good breathing can improve energy efficiency and reduce fatigue by affecting the nervous system.
- Incorrect running posture interferes with normal diaphragm movement and chest expansion.
- Inhale and exhale through your nose, during low and medium intensity running.

Easy paced run	3:3 / 4:4
Moderate paced run	2:2
Hard paced run	1:2 / 2:1

3 STRATEGIES TO TRAIN FOR RUNNING

1) ASSESSMENT

2) SPECTRUM OF RUNNING STRENGTH

3) RUNNING ROUTINE



9 MOVEMENT ASSESSMENTS FOR RUNNING

✓ Posture

1. Toe-touch

2. Back Extension

3. T-Spine Rotation / lateral flexion

4. 6-way of hip

5. Toes up, Toes down

6. Overhead Squat

7. Single leg Squat

8. Single leg wall calf raise

9. Jump Landing

9 MOVEMENT ASSESSMENTS FOR RUNNING

- Posture



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1. Toe-touch



9 MOVEMENT ASSESSMENTS FOR RUNNING

2. Back Extension



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3. T-Spine Rotation

/

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9 MOVEMENT ASSESSMENTS FOR RUNNING

9. Jump Landing



SPECTRUM OF RUNNING STRENGTH

✓ Optimal stress distribution

✓ Development of running techniques

✓ Running Economy

Tendon / Elastic Strength

Muscular Strength Joints /
Force absorption / Propulsion capacity

Mobility & Stability

MOBILITY AND STABILITY WORKS

A grayscale photograph of a group of runners on a track, viewed from behind. The runners are wearing white t-shirts and dark shorts. One runner in the foreground on the right has a bib number 874. The background shows a large crowd of runners stretching into the distance.

1. Foot and Ankle

2. Knee

3. Hips

4. Lumbo-pelvic

5. Spine

6. Shoulder

MOBILITY AND STABILITY WORKS

1. Foot and Ankle



MOBILITY AND STABILITY WORKS

1. Foot and Ankle



MOBILITY AND STABILITY WORKS

1. Foot and Ankle



MOBILITY AND STABILITY WORKS

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MOBILITY AND STABILITY WORKS

1. Foot and Ankle



MOBILITY AND STABILITY WORKS

1. Foot and Ankle



MOBILITY AND STABILITY WORKS

2. Knee



MOBILITY AND STABILITY WORKS

2. Knee



MOBILITY AND STABILITY WORKS

2. Knee



MOBILITY AND STABILITY WORKS

3. Hips



MOBILITY AND STABILITY WORKS

3. Hips



MOBILITY AND STABILITY WORKS

3. Hips



MOBILITY AND STABILITY WORKS

4. Lumbo-pelvic



MOBILITY AND STABILITY WORKS

4. Lumbo-pelvic



MOBILITY AND STABILITY WORKS

5. Spine



MOBILITY AND STABILITY WORKS

5. Spine



MOBILITY AND STABILITY WORKS

5. Spine



MOBILITY AND STABILITY WORKS

6. Shoulder



MOBILITY AND STABILITY WORKS

6. Shoulder



MOBILITY AND STABILITY WORKS

6. Shoulder



STRENGTH WORK: ABSORPTION AND PROPULSION

Propulsion Capacity

1. Hip Extension
2. Step Up
3. Hamstring Ball Roll-in

1. Lunge
2. Single leg ball squat
3. Deadlift: Both, Single
4. Heel Drop
5. Box Jump
6. Side Jump
7. Hop: Both, Single leg

Absorption Capacity

1. Hip Hike
2. Step Down

STRENGTH WORK: ABSORPTION AND PROPULSION

Propulsion Capacity

1. Hip Extension



STRENGTH WORK: ABSORPTION AND PROPULSION

Propulsion Capacity

2. Step Up



STRENGTH WORK: ABSORPTION AND PROPULSION

Propulsion Capacity

3. Hamstring Ball Roll-in



STRENGTH WORK: ABSORPTION AND PROPULSION

Absorption Capacity

1. Hip Hike



STRENGTH WORK: ABSORPTION AND PROPULSION

Absorption Capacity

2. Step Down



STRENGTH WORK: ABSORPTION AND PROPULSION

1. Lunge



STRENGTH WORK: ABSORPTION AND PROPULSION

2. Single leg ball squat



STRENGTH WORK: ABSORPTION AND PROPULSION

3. Deadlift: Both



STRENGTH WORK: ABSORPTION AND PROPULSION

3. Deadlift: Single



STRENGTH WORK: ABSORPTION AND PROPULSION

4. Heel Drop



STRENGTH WORK: ABSORPTION AND PROPULSION

5. Box Jump



STRENGTH WORK: ABSORPTION AND PROPULSION

6. Side Jump



STRENGTH WORK: ABSORPTION AND PROPULSION

7. Hop: Both



STRENGTH WORK: ABSORPTION AND PROPULSION

7. Hop: Single leg



RUNNING ROUTINE

Warm-up jog

A short, easy jog provides a general warm-up to increase your body temperature, improve blood flow to muscles, and prepare the neuromuscular system for activity.



10-15
MINUTES



Stretches and drills

A dynamic stretching routine with running-specific drills will take your joints through the required range of motion for running and prepare your neuromuscular system for more intense activity.



10-15
MINUTES



Your run

During your workout, pay attention to your form and any asymmetries or deviations from your normal running gait. As you fatigue, some of these may become more pronounced.

Wearable sensors that detect these changes may be of use, as they help you pick up on patterns or changes prior to the onset of pain or injury.



Recovery jog

A slow recovery jog is not really necessary after easy runs, but may be beneficial after more intense workouts, enabling you to slow down your heart rate as you gain some extra mileage.



10-15
MINUTES



Recovery stretches

Static stretches can encourage you to relax after a hard workout. They may help to reduce post-run stiffness and soreness, and contribute towards maintaining muscle and joint flexibility.

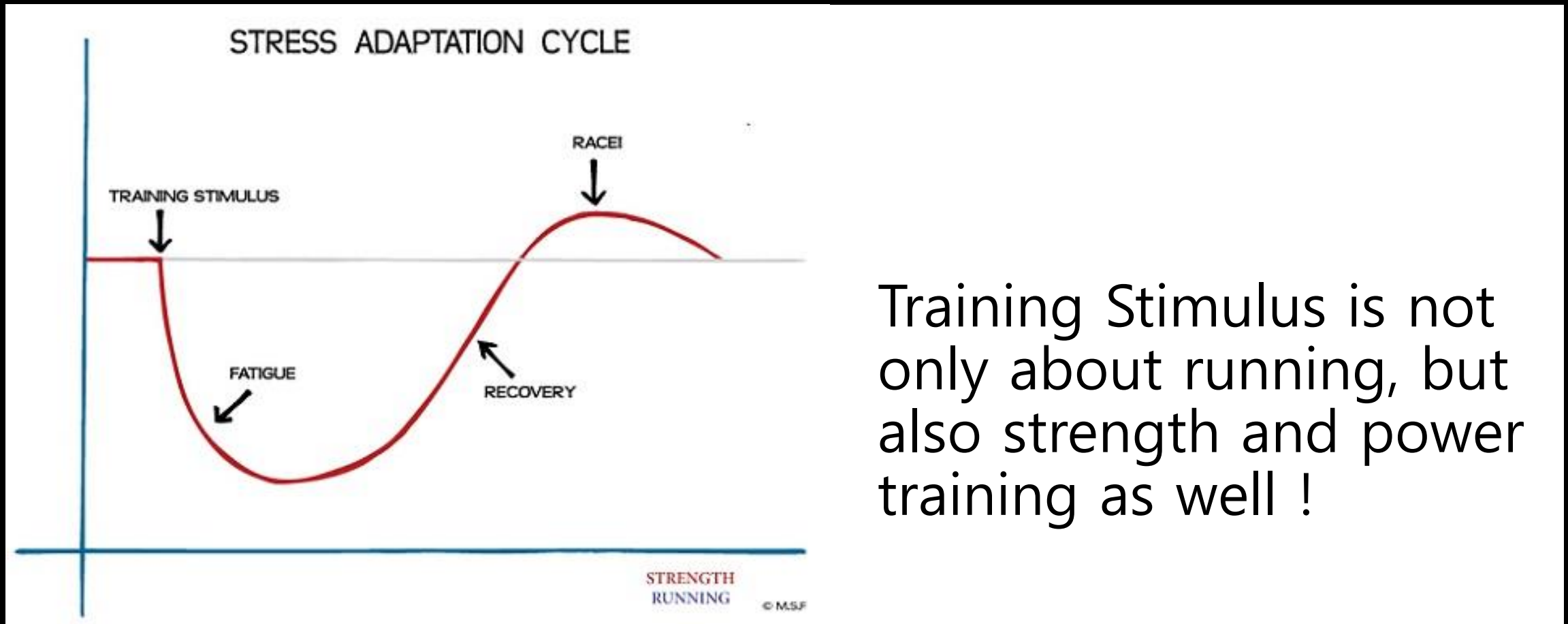


10
MINUTES



50% REDUCTION IN RISK OF OVERUSE INJURY IS POSSIBLE FROM A **WARM-UP PROGRAM**

WHY WE NEED TIME? SUPER-COMPENSATION!



Training Stimulus is not only about running, but also strength and power training as well !



WE WERE ALL BORN TO RUN

**TRAIN SMART.
RUN SMART.**

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