

Health Challenges in Olympic Athletes

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Learning Objectives

- Identify/describe genes proposed to be associated with athletic performance
- Identify/describe several genetic/environmentally associated disease in Olympic athletes
- Identify/describe the IOC's efforts to recognize and improve care of mental health issues found in Olympic athletes



Is Athletic ability inherited?

- MAYBE! No single determinant of athletic success; there are genes that may predict certain types of performance
- Complex multifactorial trait influenced by both genetic & environmental factors
- Recent advances in genetic technology explored genetic underpinnings of elite performance
- >200 gene polymorphisms id'ed with association to exercise performance, >20 correlated with elite athletic performance
- Elite athletes – have played sports at national or international level

First example



- Erythropoietin (EPO)
- 1964 Winter Olympics Innsbruck, Austria
- Eero Antero Mäntyranta - 3 gold, 2 silver, 2 bronze (1960's)
 - Mutation in the EPO receptor gene (EPOR); 1993; Autosomal Dominant –constitutively active EPO signaling
 - Primary Familial and Congenital Polycythemia
 - Increased red cell mass and hemoglobin levels leading to increased endurance- 25-50% greater oxygen carrying capacity –Endurance sports

EPO and doping

- Recombinant EPO – used for treating anemia of kidney failure, myelodysplasia, & cancer chemotherapy
- Pharmacological doping
- Ergogenic – intended to enhance physical performance, stamina, or recovery
- EPO use and blood transfusions banned by the IOC for Olympic athletes
- Remember, Tour de France
- Bronze in 2000, rescinded in 2013



Gene Doping

- Gene therapy - inserting DNA to restore function related to a damaged or missing gene
- Gene Doping - inserting DNA for the purpose of enhancing athletic performance
- International Olympic Committee (IOC) and World Anti-Doping Agency (WADA) prohibit

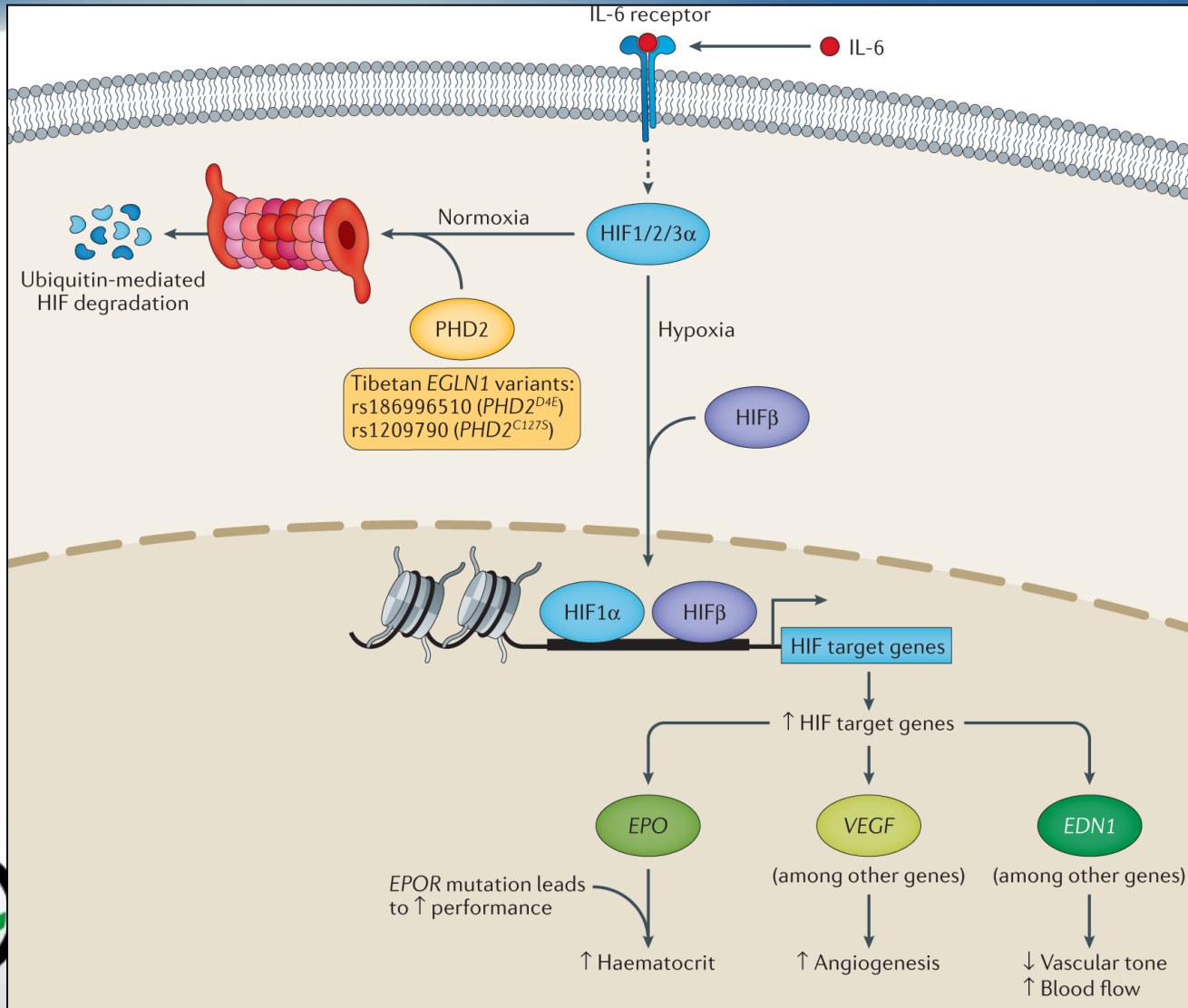


Suspected EPO doping - atypically high H/H

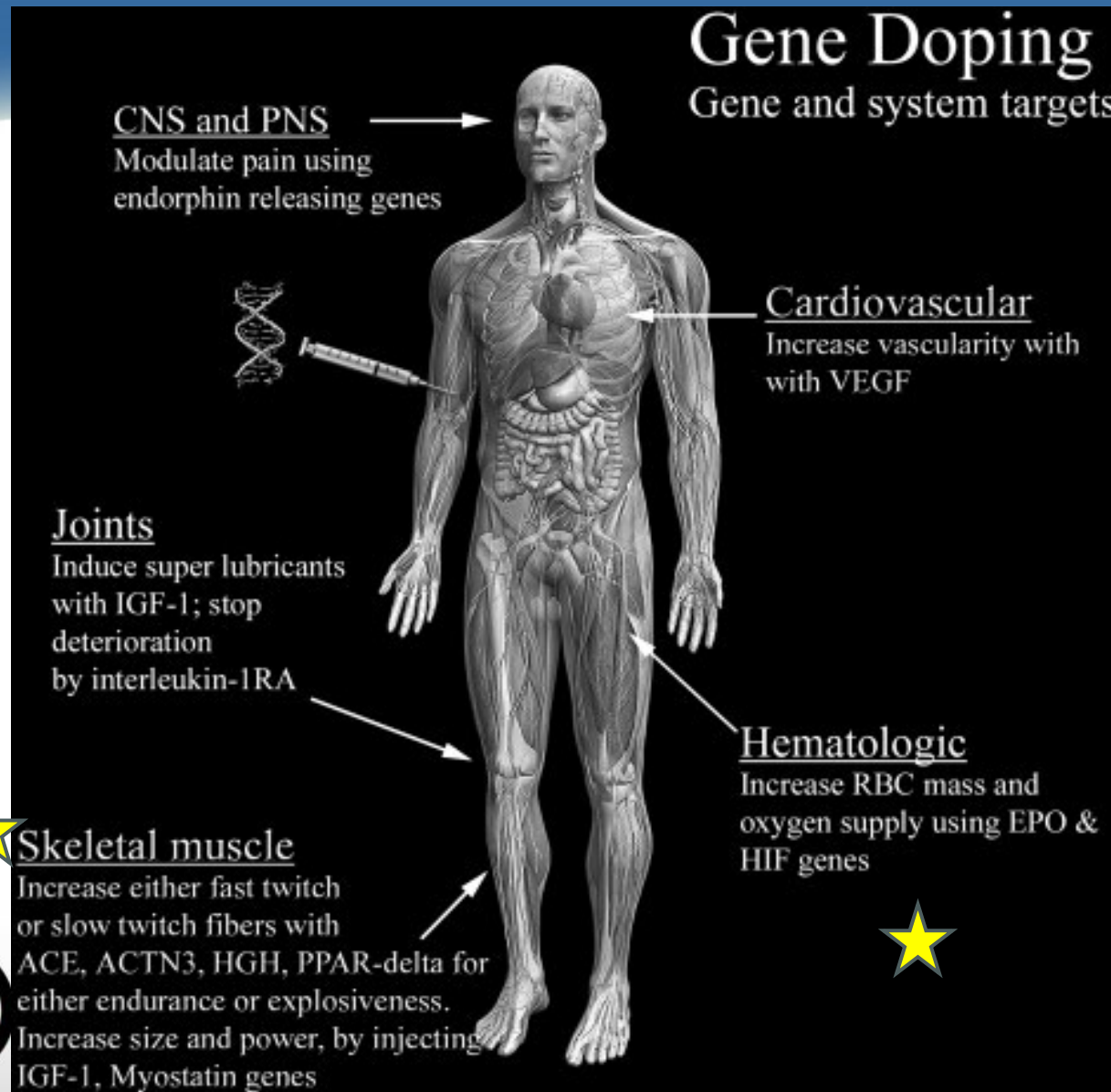
- 2 cases -athletes banished from their sport (suspected EPO doping)
- They has high levels of hemoglobin & hematocrit 20.3/57.6% M; 17.0/51% F
- 18 yrs later – M son –polycythemia; 10 yrs later F sister –idiopathic polycythemia
- Mutations found by NGS: M - *EPAS1* –encodes HIF (Hypoxia Inducible Factor) 2. *EGLN1* prevents HIF from degradation.



HIF



Genes that may be used in doping



Is Athletic ability inherited?

- Case study of 5 elite British track and field Olympians genotype scores compared to >500 non athlete controls
- Could not reliably distinguish athletes from non-athletes
- Athletic performance is influenced by a complex interaction between genetics, training, environment, and other factors



Craig Pickering, sprinter

- World class sprinter and bobsledder
- Academic researcher in sports performance



VO₂ max (maximal oxygen consumption)

- Measures how much your body is using oxygen while exercising
- Good indicator of fitness level; HIGHER means more fit; HIGHER in elite athletes
- The more oxygen you use, the more ATP your muscles produce. ATP = energy for the muscles to work.



VO₂ max is affected by the function of numerous organs

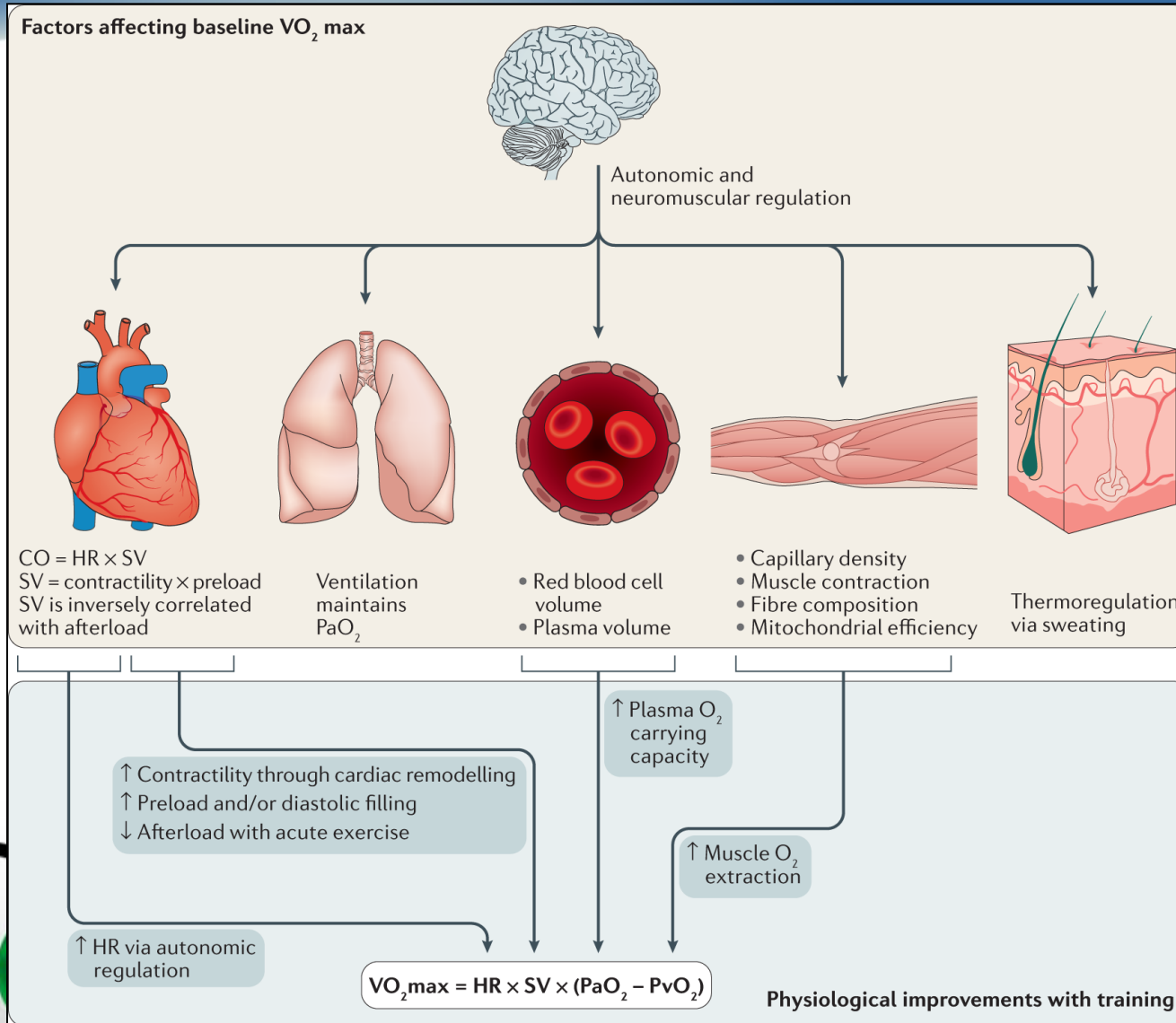
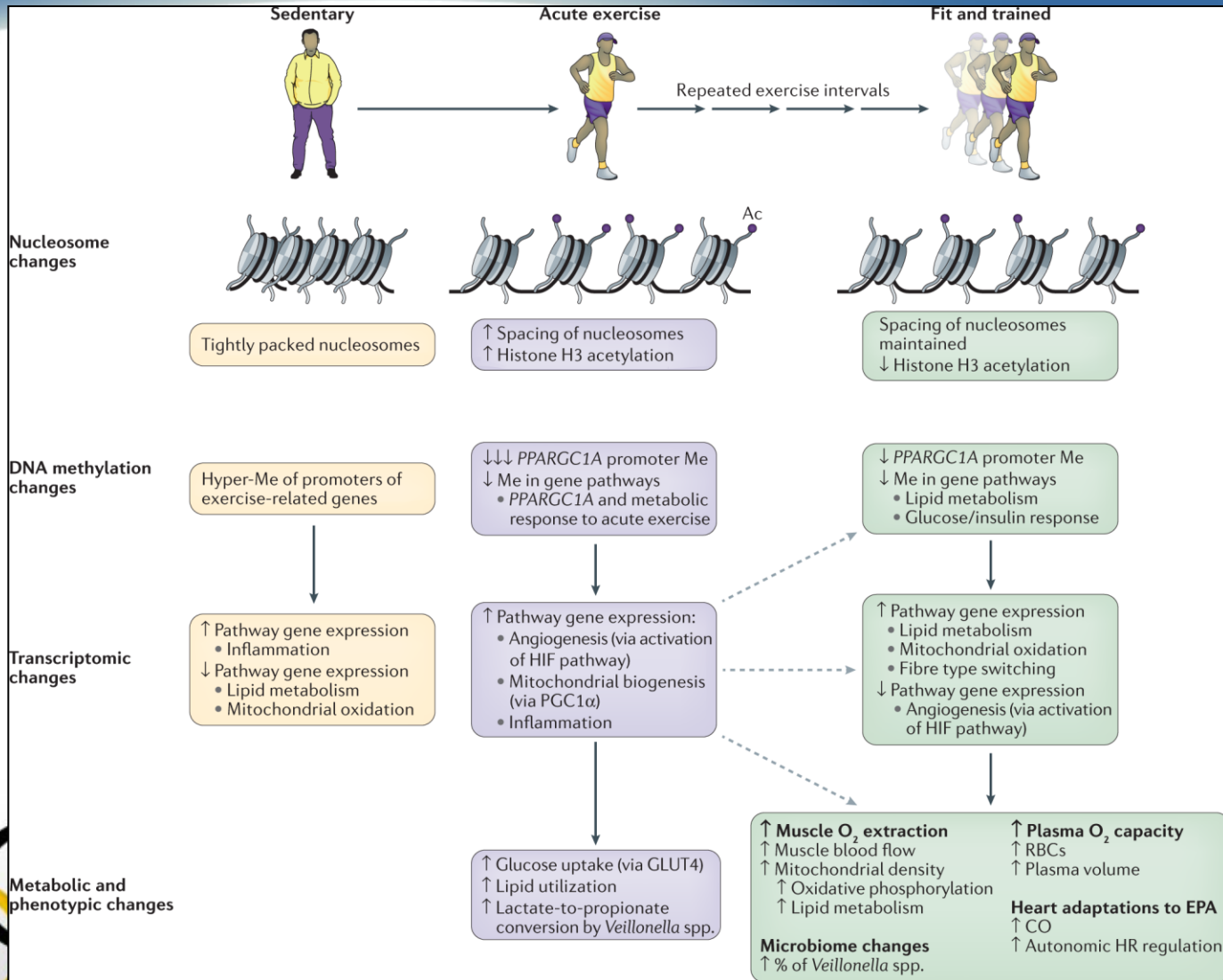


Fig. 4: Summary of molecular changes with acute exercise and long-term endurance training

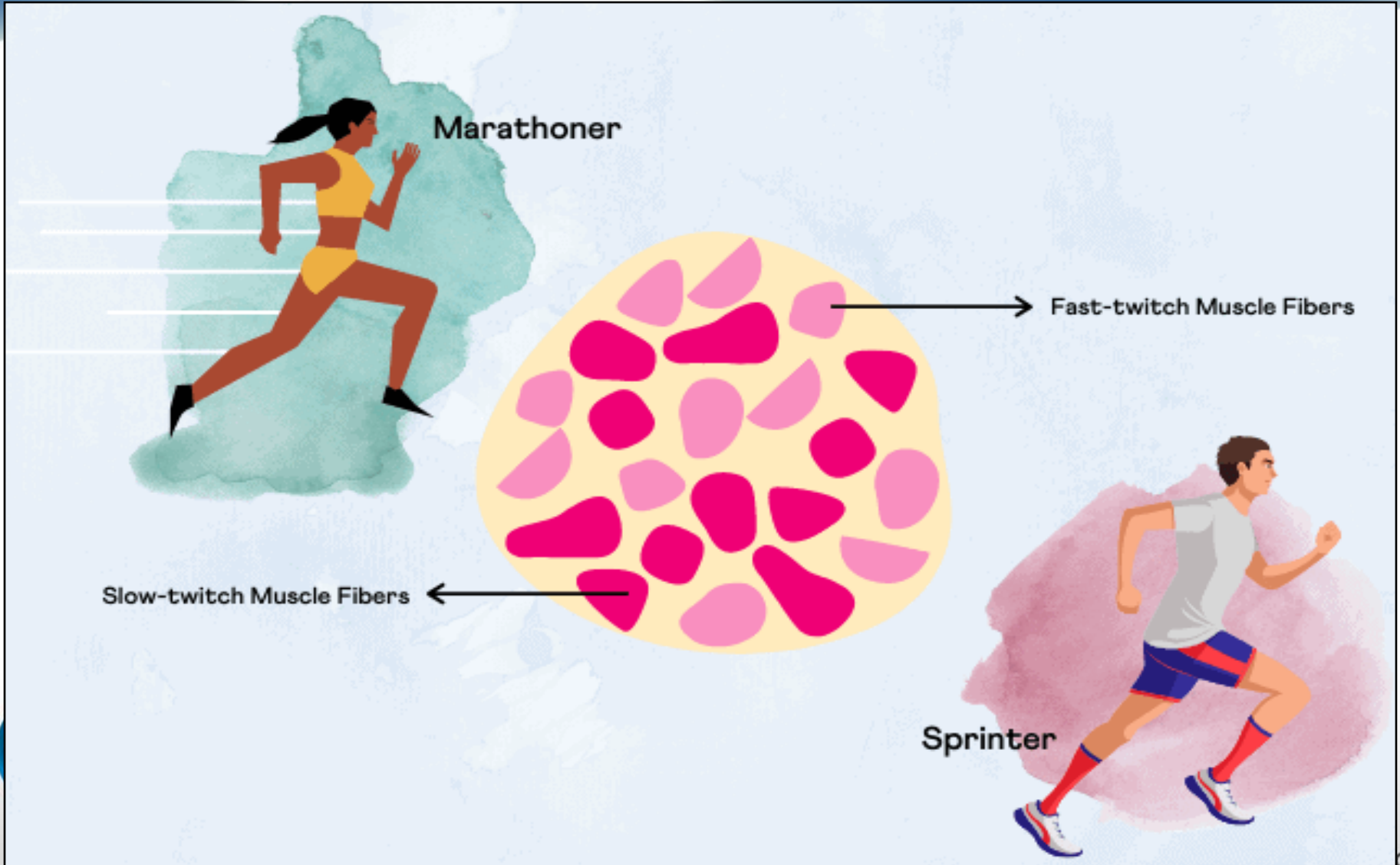


Types of muscle fibers and physical performance

- Slow-twitch (type 1)
 - “Red” fibers –rich in blood vessels & mitochondria
 - Endurance activities – marathon running
- Fast-twitch (type 2)
 - “White fibers” –fewer blood vessels & mitochondria –sprinting



Muscle types



Alpha-actinin-3 (ACTN 3 gene)

- Marathon runners don't do 200 meter dashes and vice versa
- ACTN3 –well studied, “gene for speed” primarily found in type 2 muscles
- BUT
- Research has found it is associated with training adaptation post-exercise recovery, & exercise associated injuries



Variations in ACTN3 gene linked to muscle fiber changes - pluses

Genetic change	Implication
RR (or CC)	More fast-twitch fibers; likely better sprinting performance
RX (or CT)	A mix of fast and slow - twitch fibers; favors both sprinting and endurant activities
XX (or TT)	More slow-twitch fibers; likely better endurance performance



Building muscle

FAST TWITCH

Power & strength training

- High intensity, low-rep resistance training (5 reps, heavy weight)
- Plyometric training –jumping, explosive movements
- Heavy weight lifting – deadlifting, power lifting squats

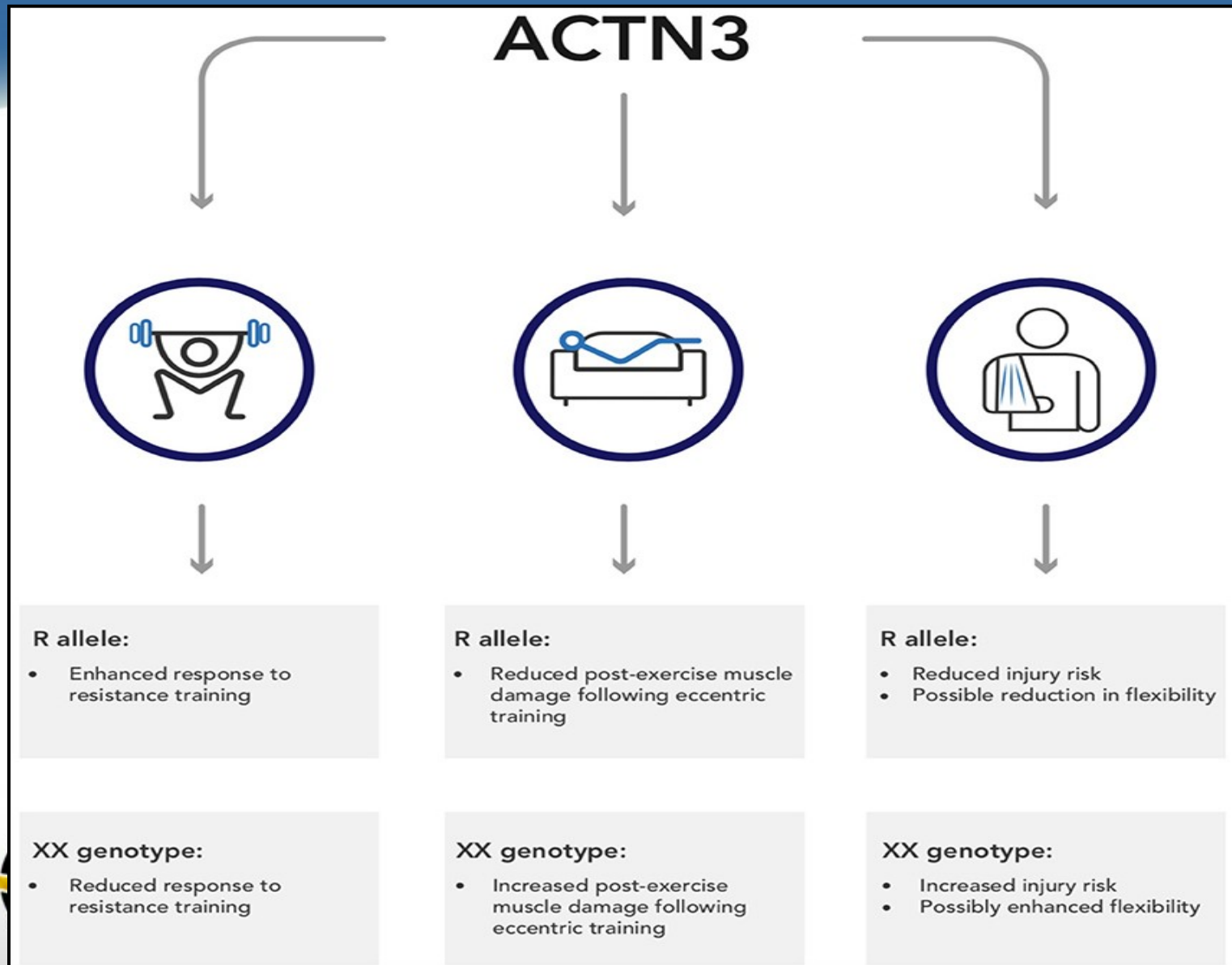


SLOW TWITCH

Endurance training

- Long duration, low intensity cardio (moderate pace jogging, swimming)
- High rep resistance training (15-20 reps, moderate weight)
- Interval training – alternating high & low intensity cardio

ACTN 3 gene -pluses and minuses

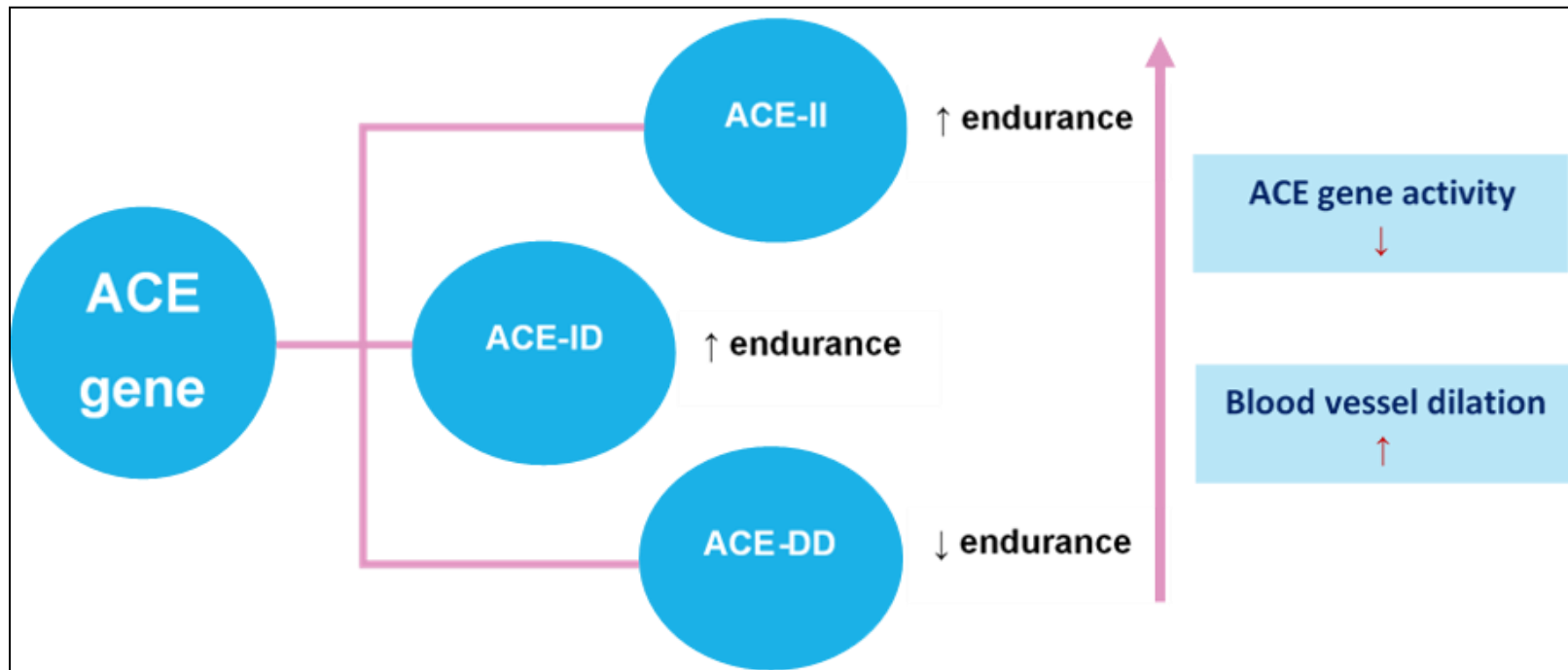


Angiotensin 1-converting enzyme (ACE) gene

- Part of the renin-angiotensin system
- Converts angiotensin I to angiotensin II
- Angiotensin II causes blood vessel constriction
- ACE I/D polymorphism – 3 types
 - Two copies of D: DD pattern – highest levels of ACE; higher proportion of fast twitch muscle & greater speed
 - Two copies of I: II pattern – improved endurance at high altitudes & in army recruits
 - One copy of each ID pattern



Angiotensin 1-converting enzyme (ACE) gene



Caffeine -another ergogenic substance

CAFFEINE PERFORMANCE ENHANCER?



Can **enhance performance** when consumed **15-60mins** before exercise



WADA WADA has caffeine on their **'monitoring program'**.



Benefits for strength and power activities/sports **still fully unknown.**



Effective **ergogenic aid** for sustained maximal **endurance** activity and time trial **performance.**



Increases dopamine levels, which makes you feel **happier.**



Blocks adenosine receptors, which **stops** you getting **drowsy.**

Enhances glycogen resynthesis during **recovery.**



SPORT SCIENCE
COLLECTIVE

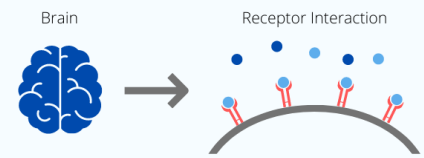
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YOUR GUIDE TO CAFFEINE

CAFFEINE SUPPLEMENTATION HAS CONSISTENTLY BEEN SHOWN TO IMPROVE RESISTANCE TRAINING PERFORMANCE

HOW DOES IT WORK?

Caffeine may make us feel more 'energetic', but it does not actually give us energy. Rather, it acts as a stimulant to the central nervous system by antagonising adenosine receptors.



When **adenosine** binds to its receptor, this causes relaxation and sedation. **Caffeine** prevents this binding process, thus delaying fatigue.

CAFFEINE BENEFITS

Caffeine reduces our perception of effort during exercise. It has reliably been shown to improve anaerobic and aerobic running capacity, strength + power output and much more!



Instant Coffee
~60mg per tsp



Espresso Coffee
~80mg per shot



Caffeine Pills
100-200mg per pill



Black Tea
~40mg per bag



Pre-Workout
~100-300mg/serve



Energy Drink
~75-300mg per can

HOW TO TAKE IT

For performance benefits, supplement with 3-6mg/kg within 1 hour of exercise. We recommend beginning with a more conservative dose of 1-3mg/kg to assess sensitivity to caffeine.



Side Effects?

Increased heart rate, anxiety and sleep disruption are common side effects of excessive or mistimed caffeine use.



Individual Response

Due to genetics, some people will be more/less sensitive to caffeine. This is where individual dosing is pertinent.

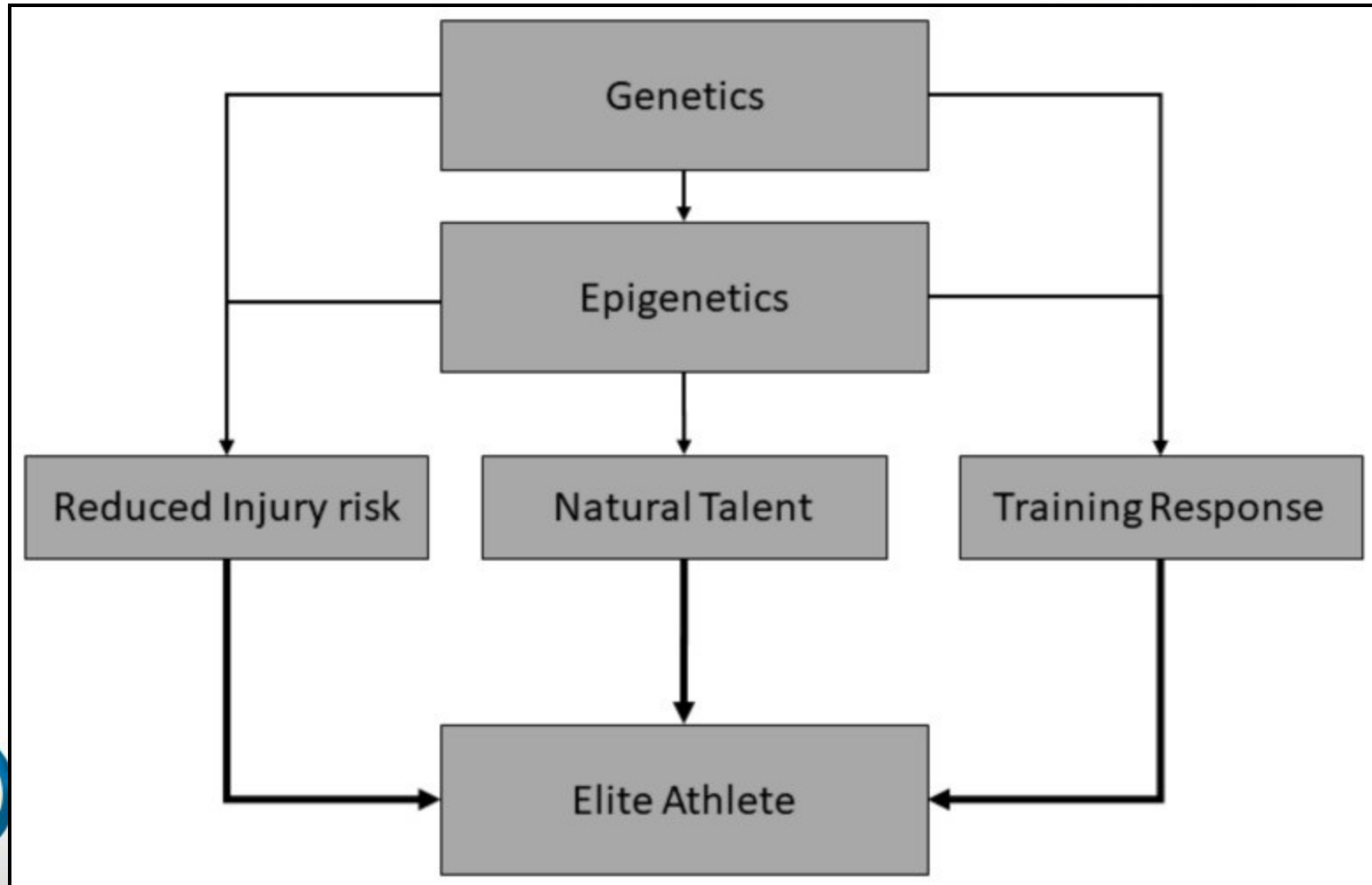


Cytochrome P450 and caffeine metabolism

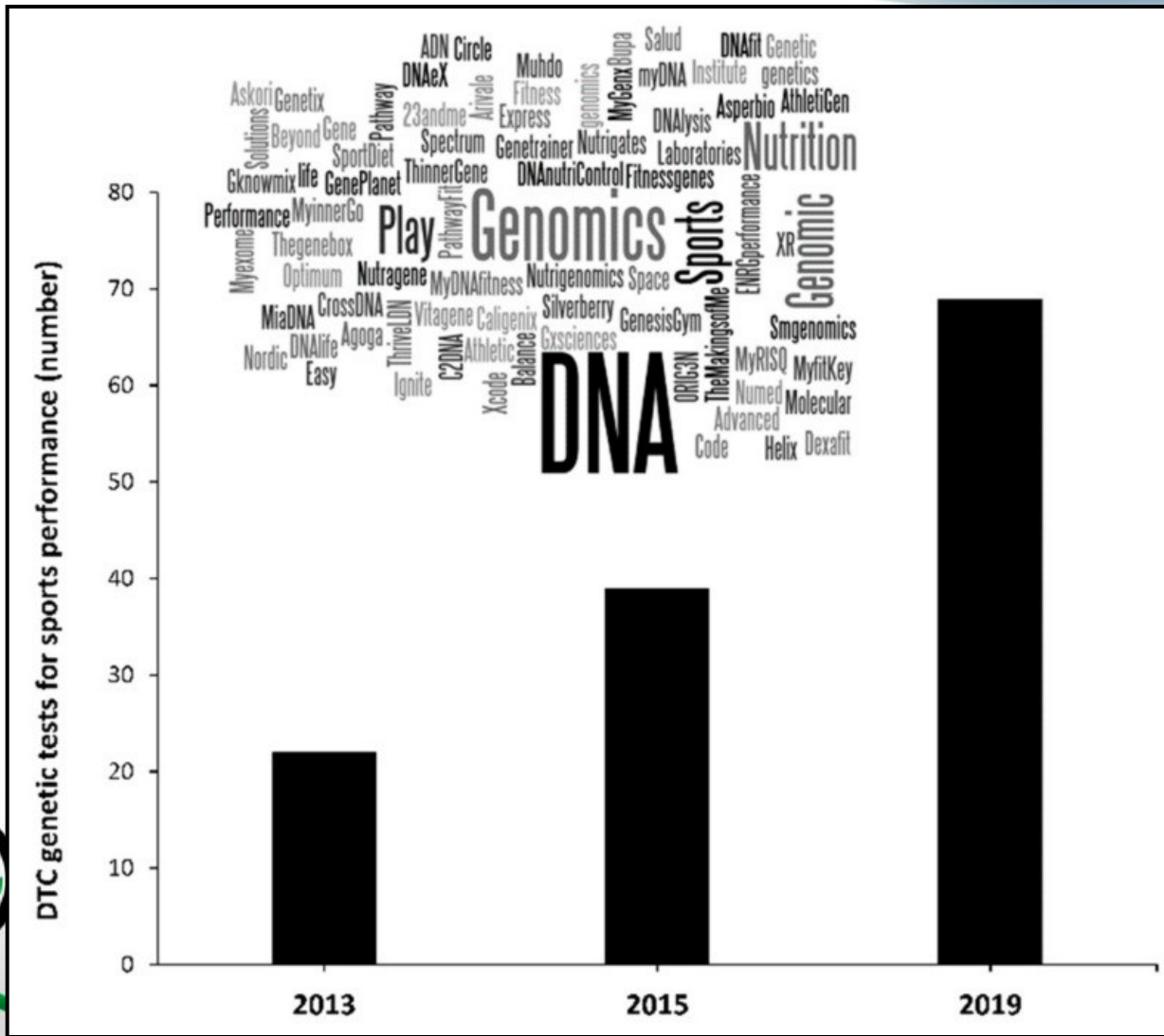
- CYP1A2 encodes cytochrome P450 1A2, responsible for caffeine metabolism
- Single nucleotide polymorphism (SNP) rs762551
- AA rs762551 genotype –fast caffeine metabolizers
- C allele carriers (AC/CC) –slower caffeine metabolizers
- Greater ergogenic effects on aerobic endurance reported for AA genotype
- For vertical jump –no difference between groups in some studies



“Success” in sport



Direct to Consumer (DTC) tests aimed at sports people, coaches, & parents



DNAFit

- Direct-to-consumer genetic testing company that provides DNA-based insights into diet, fitness, and wellness

	Price	What you get	Results turnaround
Diet Fit	\$151	11 diet insights 13 nutrient insights Personalized meal plans	10-15 business days
Health Fit	\$199	11 diet insights 13 nutrient insights 11 fitness insights 5 stress and sleep insights Personalized meal plans Training plans	10-15 business days
Circle Premium	\$629	15 diet insights 20 nutrient insights 18 sports and fitness insights 8 stress and sleep insights 7 well-being reports Health reports including cancer, dementia, and 65 others Ancestry report Health coach consultation Genetic counsellor consultation	around 18 business days



“Common” Diseases in Olympic Athletes

- Asthma: According to the International Olympic Committee, 1 in 5 summer athletes suffer from exercise-induced bronchoconstriction; higher in winter athletes
- Breathing high volumes of cold air dries out the airways



Asthma can be

- Intermittent –comes and goes, feel ok in between
- Persistent –have symptoms most of the time
- Exercise-induced
- Asthma – COPD overlap syndrome



Asthma

- Chronic lung disease; Affects all ages
 - Pediatric begins before age 5, infants & toddlers – children may “grow out” of it (1 in 11 -CDC)
 - Adult onset starts after age 18 (1 in 12 -CDC)
 - Affects women > men, blacks > other races starts
- Inflammation, muscle tightening around the airways, more mucus production
- Symptoms - Difficulty breathing, coughing, wheezing, chest tightness
- Triggers – 1. Allergic: dust mites, mold, pests, pets; 2. Non-allergic: air pollution, tobacco smoke, exercise strong chemical smells (occupational), weather
- Increasing cases (Urbanization?)

Asthma Diagnosis

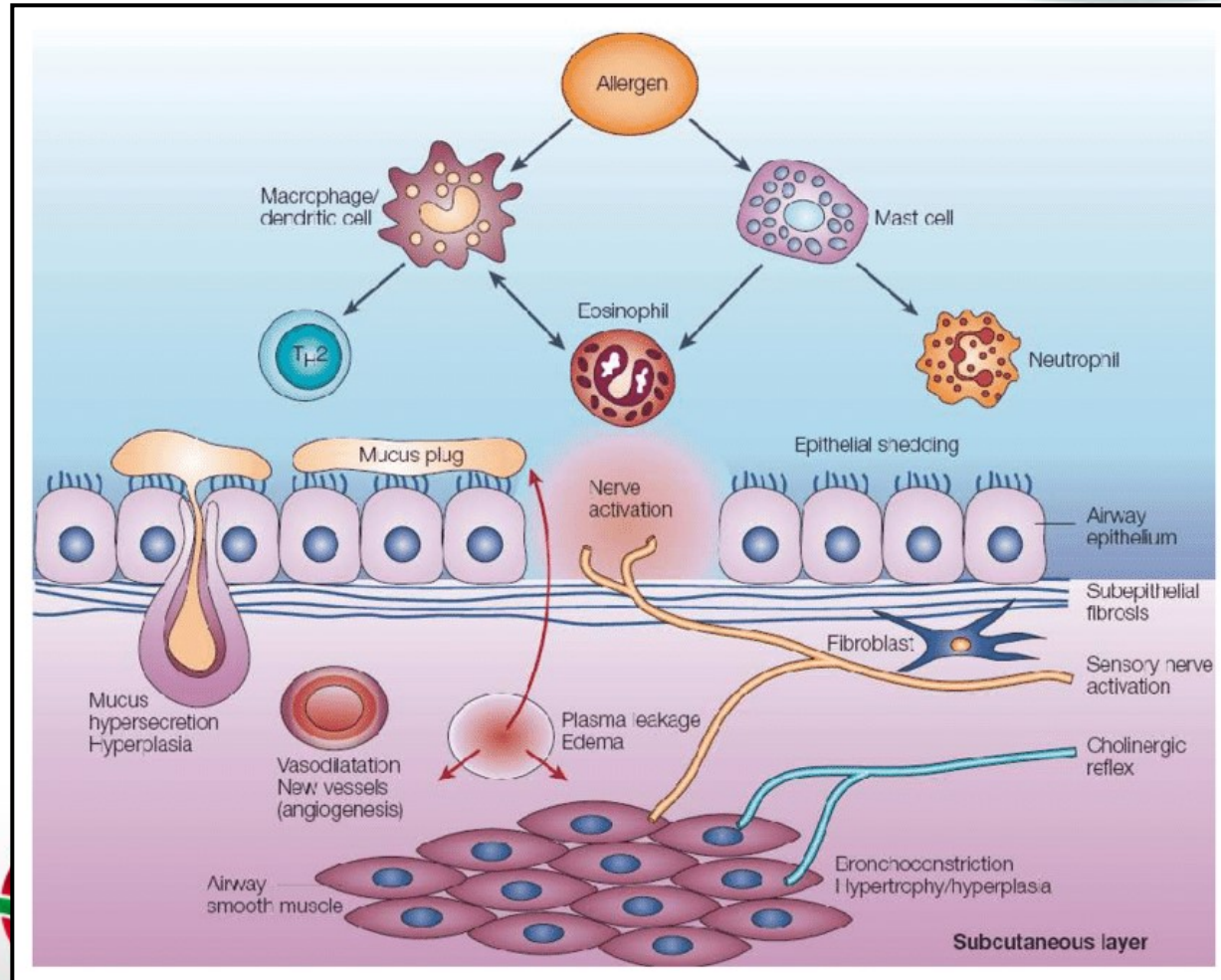
- Medical history & family medical history including history of allergies or eczema
- Symptoms
- Chest x ray
- Spirometry
- Arterial blood gases (ABGs) and pulse oximetry
–useful in assessing Rx & exacerbations
- No diagnostic labs; Eosinophilia, elevated serum IgE



Immunology of Allergic Asthma

- Childhood or adulthood
- T helper cell (Th₂) response “Pro-inflammatory”
- Allergen exposure - Th₂ cells produce type 2 cytokines: IL-4, IL-5, IL-9, & IL-13 –leads to high # of eosinophils in airway wall, mucus overproduction and synthesis of IgE by allergen specific B cells
- Airway epithelium –generates “upstream” “alarmin” cytokines –IL25, IL33 & TSLP –to direct maturation of T cells to TH2 cells

General overview Pathophysiology



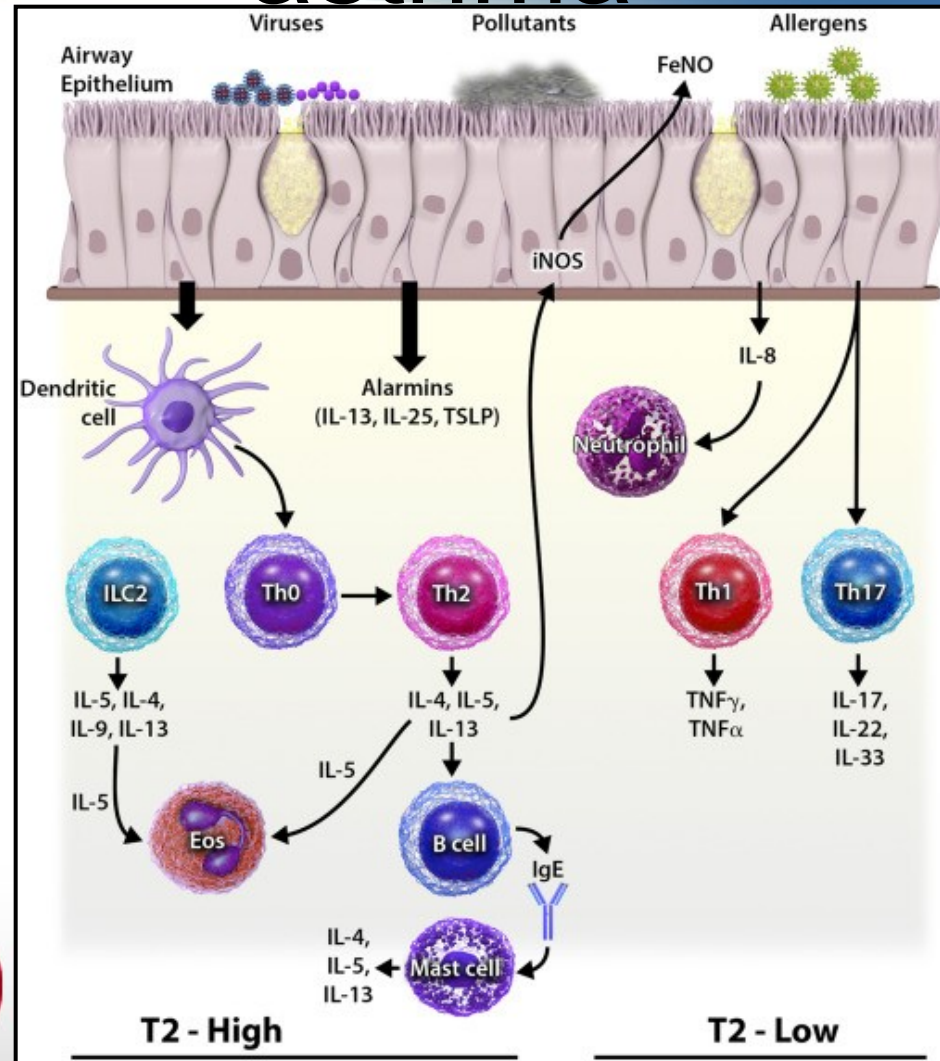
Adult onset asthma

- May be classified as Th₂ or non-Th₂
- Non-Th2 –associated with chronic recurrent rhinosinusitis with nasal polyps
- Non-Th2 associated with obesity, aging, smoking, and neutrophils

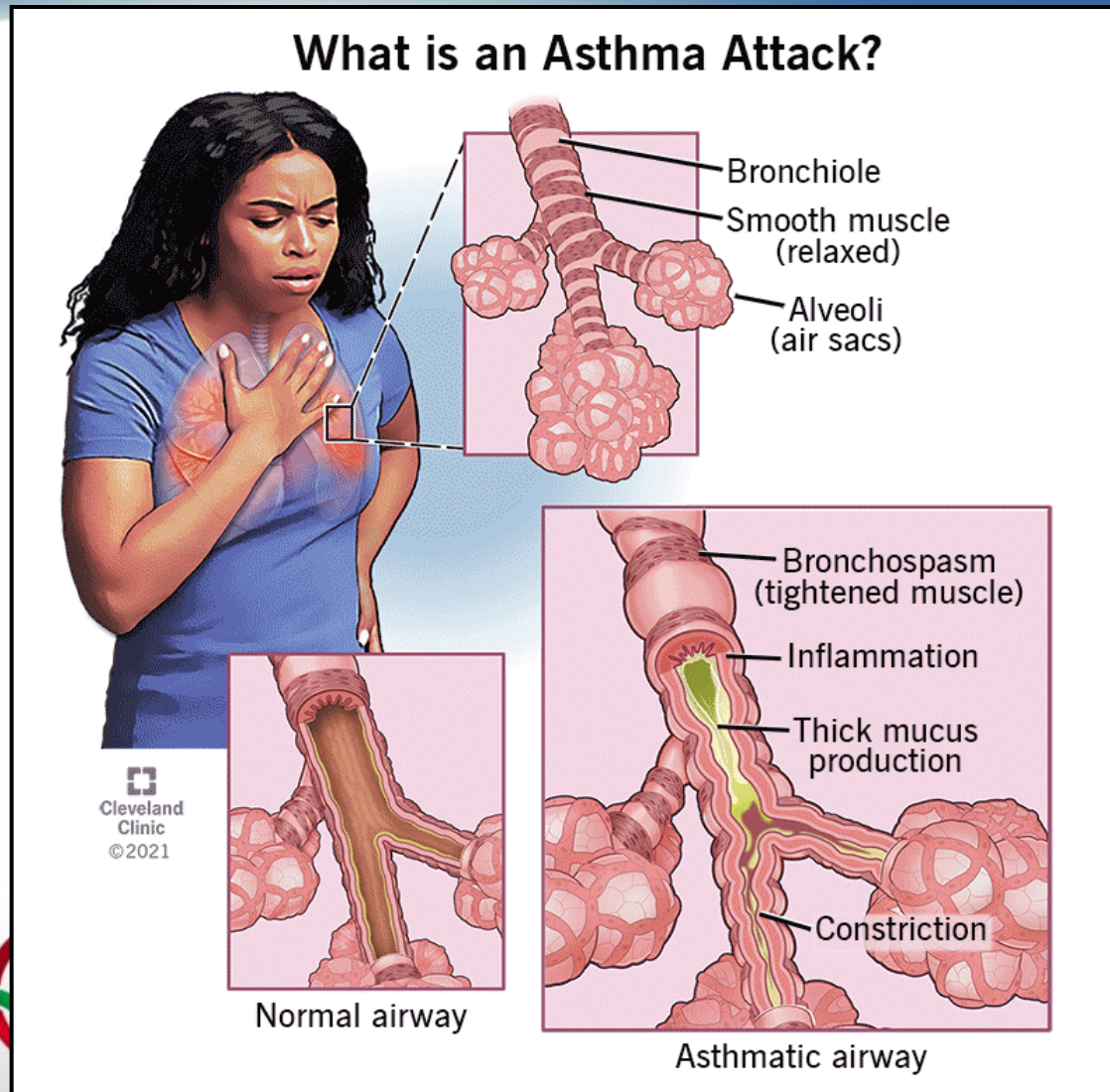
- Further re-classifications are ongoing -
Type 2 high and Type 2 low asthma



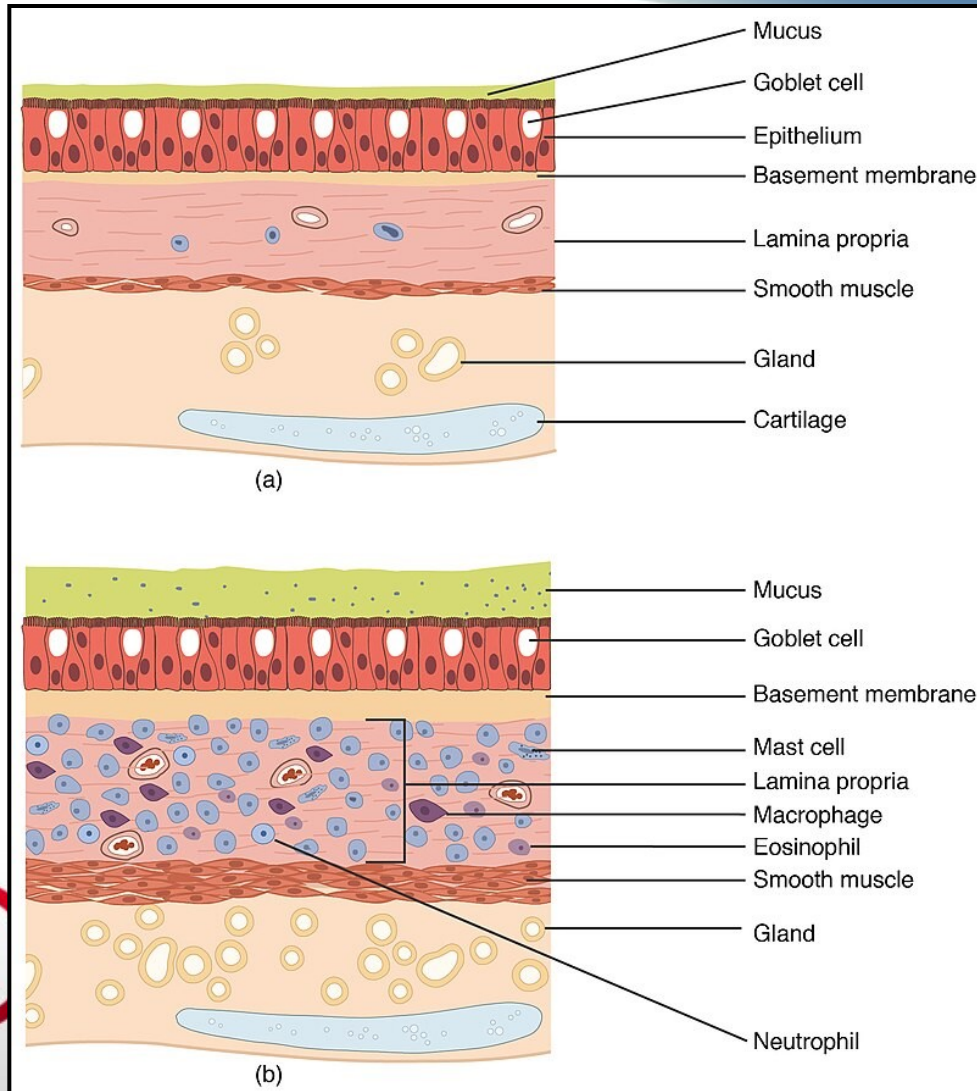
Immunological response in asthma



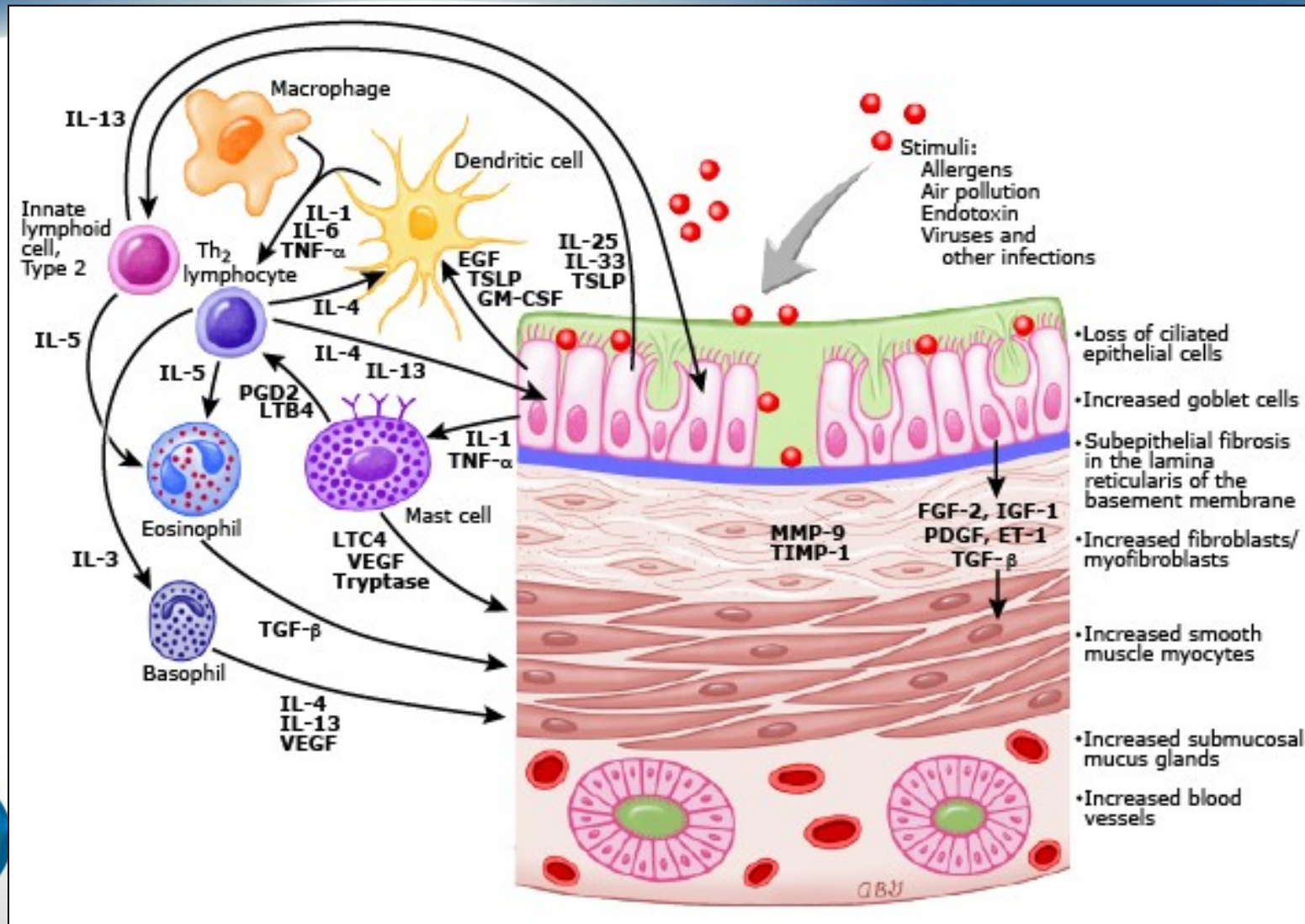
Asthma attack = Exacerbation



Normal and Bronchial asthma tissues



Airway remodeling in asthma



Preventative measures

- Skin testing to assess sensitivity to perennial indoor allergens –dust mites, cockroaches, pets, mold, pollen
- Avoidance of allergens; allergen immunotherapy –mixed results
- Environmental controls - home should be cleaned & dusted regularly



Treatment strategy for asthma

- Open up air passages & relieve symptoms
- Reduce inflammation in the air passages
- GOAL “Asthma Control” –minimal symptoms, able to do things you want at home or work, sleep without asthma interrupting your rest, rarely need to use “rescue inhaler”



GOAL –control of symptoms

- Quick relief
“rescue inhalers”
 - Short acting beta agonists (SABAs)
 - Anticholinergics
 - Systemic corticosteroids
- Long term control
 - Inhaled corticosteroids(ICSs)
 - Long acting beta agonists (LABAs)
 - Long acting anticholinergics
 - Leukotriene receptor antagonists
 - Methylxanthines



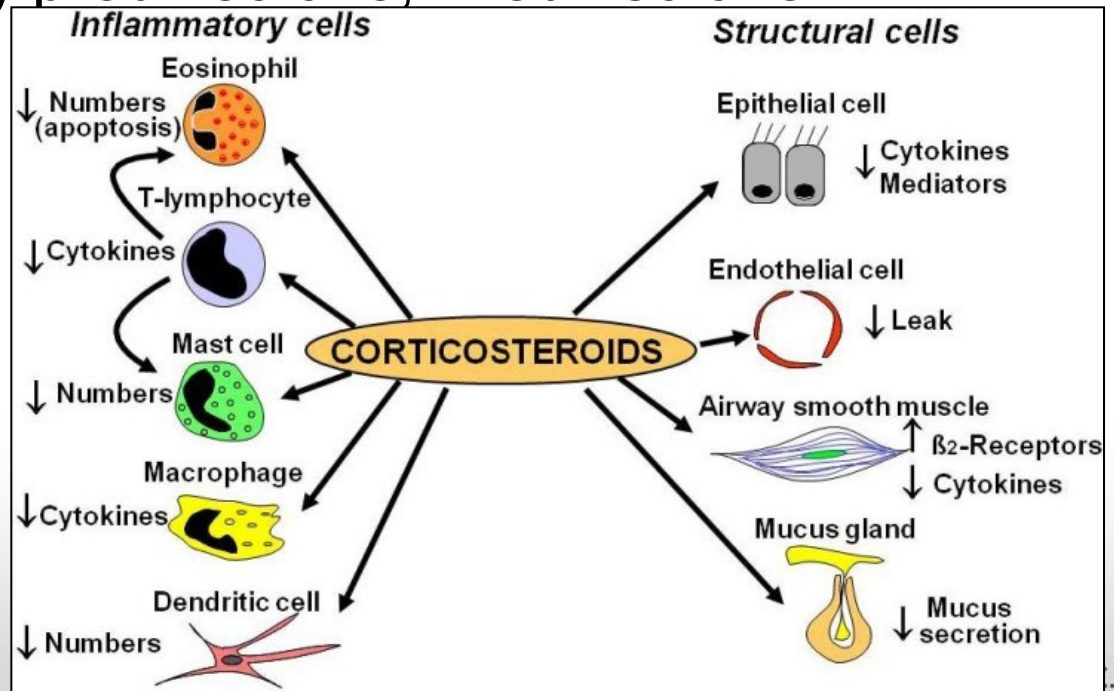
Asthma treatment strategies

- Prevention of antibody-antigen reaction(avoidance of allergen)
- Suppression of inflammation & bronchial hyper reactivity -steroids
- Sympathomimetic drugs
- Direct acting bronchodilators (methlyxanthines)
- Prevention of release of mediators
- Antagonism of released mediators
- Neutralization of IgE (Xolair)
- Biologics

Corticosteroids

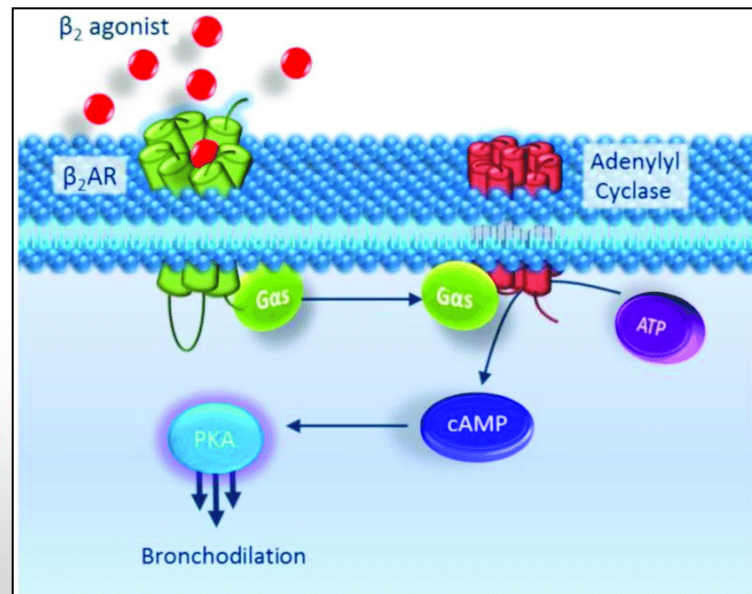
ANTI-INFLAMMATORY

- May be inhaled or taken PO
- Taken regularly to prevent symptoms
 - Beclamethasone, Budesonide
 - Prednisone, Methylprednisolone, Prednisolone



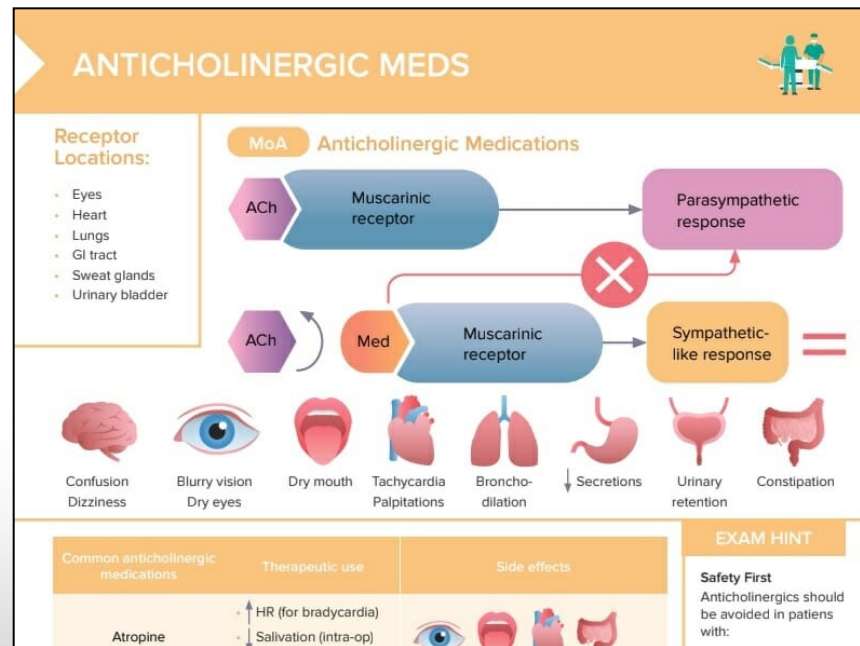
Beta2 adrenergic agonists

- Relieve reversible bronchospasm by relaxing the smooth muscles of the bronchi
 - **Albuterol** sulfate most commonly used (SABA) for acute exacerbations (rescue inhaler)
 - Formeterol – (LABA) taken every day even when don't have symptoms



Anticholinergic agents

- Both short (Ipratropium) and long acting (Tiotropium) agents that block cholinergic receptors in airways leading to smooth muscle relaxation (bronchodilation)



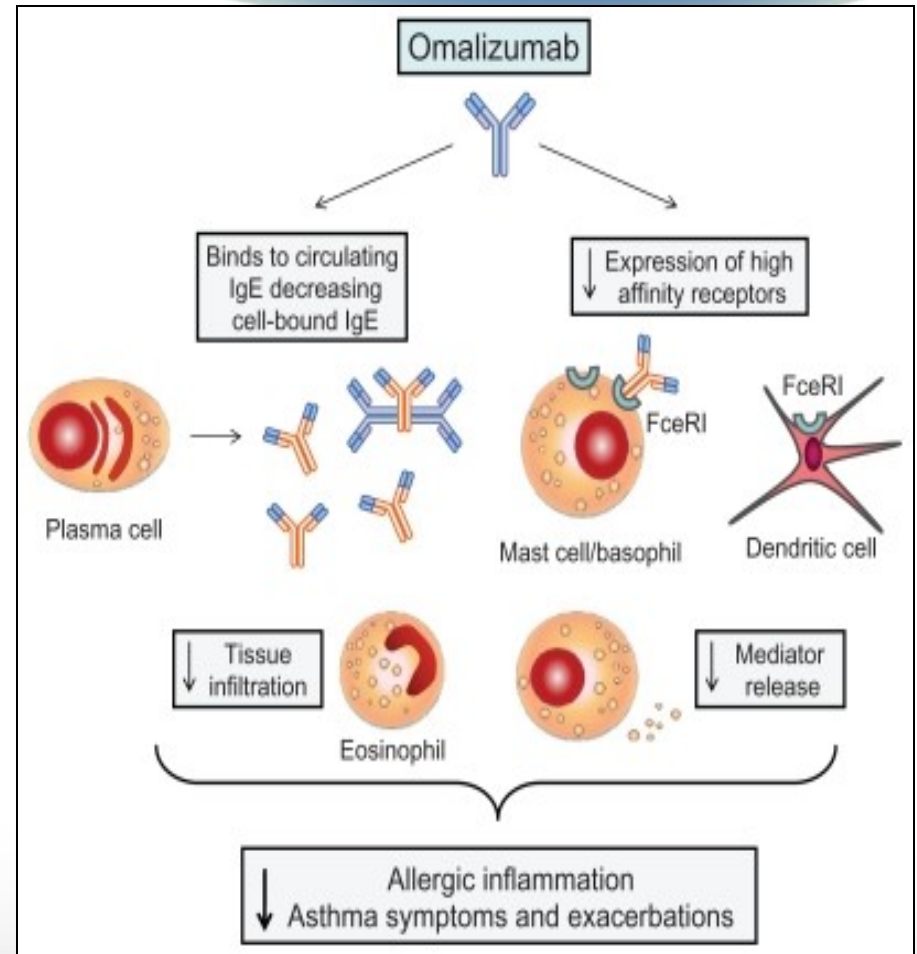
Mast Cell Stabilizers – Cromolyn Sodium

- Blocks early and late asthmatic responses
 - Interferes with chloride channels
 - Inhibits activation and release of mediators (histamine, leukotrienes) from sensitized mast cells exposed to specific antigens
 - Inhibits acute response to cold air, exercise, & sulfur dioxide



Omalizumab (Xolar) binds to IgE

- Age > 6 with moderate –severe asthma with + skin test & symptoms inadequately controlled by inhaled corticosteroids



Biologics/Immunologics

- Targeting components of Th2 pathways:
 - IL5 – decreases eosinophils, exacerbations, and increases lung function
 - IL4/IL13 –decreases exacerbations, airway remodeling, increases lung function
 - TSLP – decreases eosinophils, FeNO, IgE exacerbations, increases lung function



Olympic Athletes with Asthma

- The most common chronic condition in Olympic Athletes
 - 2002-10 study of Summer & Winter Olympic athletes found ~ 8% have asthma
 - 2022 European study of summer athletes found ~ 16.5 % had asthma
- Exercise-induced asthma (EIA)
- Intense training in Endurance sports: Running, cycling, swimming; Also alpine skiing, figure skating, snow boarding, curling



What athletes have asthma?

- Noah Lyles - runner (2024 Paris)
- Mark Spitz - swimmer
- Greg Louganis - diver
- Apolo Ohno (speed skating)
- Kristi Yamaguchi - Figure skater
- Jackie Joyner-Kersey – track & field



Swimming

- Highest prevalence of asthma
 - Level of endurance
 - Chlorine byproducts at surface area of pool



Treatment of Asthma at the Olympics

- Glucocorticoid inhalers (brown inhalers) are fine
- Restrictions on beta 2 agonist inhalers; case by case basis (World Anti-Doping Agency WADA)
 - “Blue Inhalers” (Rescue Inhalers) - only 6 inhalations in an 8 hr period
- Data on performance enhancement is mixed



Mental Health/ Illness

- 2019 meta analysis in British Journal of Sports Medicine – 20% of elite athletes struggle with alcohol use & 25% are at risk of mental health problems –depression, anxiety and eating disorders
- 2023 International Olympic Committee issued an action plan



Mental Health issues in Olympic Athletes

- Intense pressure to perform, constant scrutiny from media, fans, sacrifices made in personal lives -higher risk of developing anxiety, depression, & substance abuse
- May focus on negative thoughts that lead to being overwhelmed –due to their own perfectionism, unrealistic expectations
- Therapy including Cognitive-Behavioral Therapy (CBT)

Cognitive-Behavioral Therapy

- A type of psychotherapy that helps ID and challenge negative thought patterns and learn how to respond to challenging situations in a more effective way
- Can help with depression, anxiety, PTSD, eating disorders, substance abuse



Mental Health

- 2020 Olympic Games in Tokyo delayed until 2021 due to the pandemic
- 2021 – Simone Biles withdrew from the competition – suffering from the “twisties”
- Has made therapy part of her weekly routine
- Advocate for mental health and has shown that it's okay to prioritize your mental health over winning; has inspired other athletes to prioritize their mental health
- Paris 2024 –Biles got 4 medals- Gold Team, Gold all around, Gold -vault, silver floor exercise



Mental health: The courage to speak... and hit pause



Michael Phelps, swimmer

- 28 medals; 23 gold during 4 Olympic games
- Substance abuse –DUI 2004, 2014
- Anxiety & Depression during his entire career, culminating in suicidal ideation after 2012 games
- After Biles withdrew from the Olympics, Phelps supported her decision

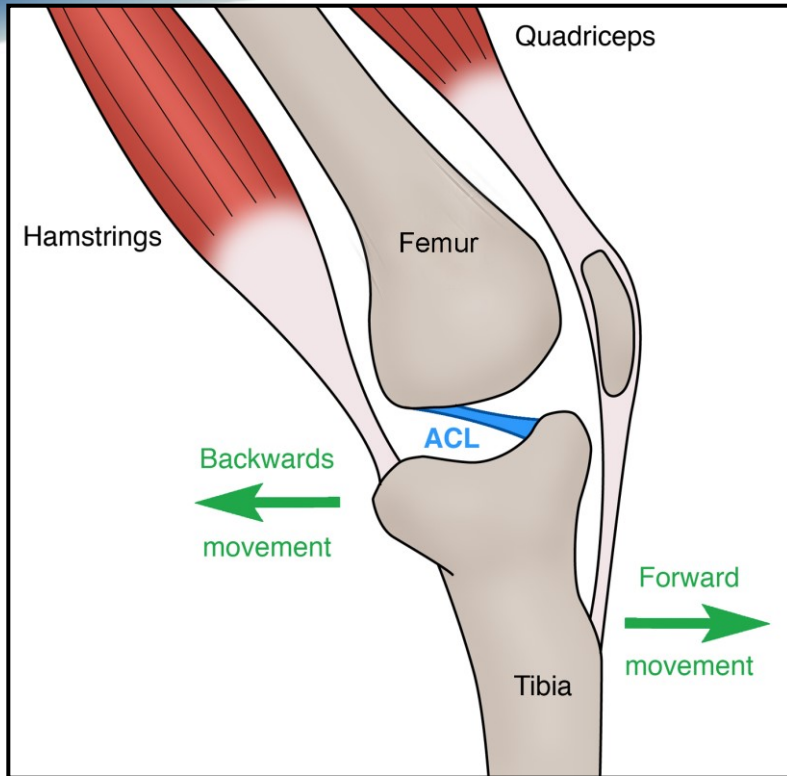


“What you have does not define what you can become”

Mental health isn't its own entity.
It's everyday life.



Injuries



- Most common – Anterior Cruciate Ligament (ACL) tears
- Planting and pivoting twist the ACL to keep your knee together –so is common injury
- More common in women
- Connects the bottom of the thigh bone (femur) to the top of the shin bone (tibia) at the knee
- Knee swelling, pain & instability while standing
- Soccer, football, basketball, downhill skiing



ACL treatment

- Rest; brace, weight bearing crutches
- Physical therapy
- Arthroscopic Surgery
- Partial knee replacement

- Injury Prevention (FIFA 11+ 20 min. warmup; Jump Land Training)



Fédération Internationale de Football Association

FIFA 11+

PART 1 RUNNING EXERCISES - 8 MINUTES



1 RUNNING STRAIGHT AHEAD

The coach is made up of 10 pairs of parallel cones, spaced 10 metres apart. Two players start at the same time from the first pair of cones. **Key together!** of the way to the last pair of cones. On the way back, you can increase your speed progressively as you warm up. **2 sets.**



2 RUNNING HIP OUT

Walk on in pairs, crossing at each pair of cones to 10 pairs and **rotate your hip outwards.** Alternate between left and right legs at successive cones. **2 sets.**



3 RUNNING HIP IN

Walk on in pairs, crossing at each pair of cones to 10 pairs and **rotate your hip inwards.** Alternate between left and right legs at successive cones. **2 sets.**



4 RUNNING CIRCLING PARTNER

Run forwards in pairs to the first pair of cones. Shuffle sideways by 90 degrees to meet in the middle. **Shuffle an entire circle around one another** and then return back to the cones. Repeat for each pair of cones. Remember to dip on your feet and keep your centre of gravity low by bending your hips and knees. **2 sets.**



5 RUNNING SHOULDER CONTACT

Run forwards in pairs to the first pair of cones. Shuffle sideways by 90 degrees to meet in the middle. **Run forwards then jump sideways towards each other to demonstrate the shoulder contact!** Note: Make sure you land on both feet with your feet and knees bent. Do not let your knees buckle backwards. Make a 45-degree angle and synchronise your timing with your teammate as you jump and land. **2 sets.**



6 RUNNING QUICK FORWARDS & BACKWARDS

As a pair run quickly to the second set of cones then **run backwards quickly to the first pair of cones keeping your hips and knees slightly bent.** After repeating the drill, turning from cones forwards and one cone backwards. Remember to take small, quick steps. **2 sets.**

PART 2 STRENGTH · PLYOMETRICS · BALANCE · 10 MINUTES

LEVEL 1



7 THE BENCH STATIC

Starting position: Lie on your front, supporting yourself on your forearms and feet. Your elbows should be directly under your shoulders.
Exercise: Lift your front body up, supported on your forearms, until your stomach is, and hold the position for 20-30 sec. Your body should be in a straight line. **2 sets.**



7 THE BENCH ALTERNATE LEGS

Starting position: Lie on your front, supporting yourself on your forearms and feet. Your elbows should be directly under your shoulders.
Exercise: Lift your front body up, supported on your forearms, and pull your stomach in. Lift one leg by hand, holding for a count of 2 sec. Continue to lift the other leg. Your body should be in a straight line. Try to keep up with each other. **2 sets.**



7 THE BENCH ONE LEG LIFT AND HOLD

Starting position: Lie on your front, supporting yourself on your forearms and feet. Your elbows should be directly under your shoulders.
Exercise: Lift one leg by hand up, supported on your forearms, and pull your stomach in. Lift one leg by hand up to 90 degrees, hold for a count of 2 sec. Repeat for the other leg. Your body should be in a straight line. Try to keep up with each other. **2 sets.**



8 SIDWAYS BENCH STATIC

Starting position: Lie on your side with the knee of your frontmost leg bent to 90 degrees. Support your upper body by resting on your forearm and knee. The elbow of your supporting arm should be directly under your shoulder.
Exercise: Lift your supporting leg and hip and your shoulder. Keep your knee in a straight line. Hold the position for 20-30 sec. Take a short break, change sides and repeat. **2 sets on each side.**



8 SIDWAYS BENCH RAISE & LOWER HIP

Starting position: Lie on your side with both legs straight. Lean on your forearm and the side of your foot so that your body is in a straight line from shoulder to foot. The elbow of your supporting arm should be directly beneath your shoulder.
Exercise: Lower your hip to the ground and raise it back up again. Repeat for 20-30 sec. Take a short break, change sides and repeat. **2 sets on each side.**



8 SIDWAYS BENCH WITH LEG LIFT

Starting position: Lie on your side with both legs straight. Lean on your forearm and the side of your foot so that your body is in a straight line from shoulder to foot. The elbow of your supporting arm should be directly beneath your shoulder.
Exercise: Lift your supporting leg and hold it straight line. Repeat for 20-30 sec. Take a short break, change sides and repeat. **2 sets on each side.**



9 HAMSTRINGS BEGINNER

Starting position: Crawl on a soft surface. Ask your partner to hold your ankles from behind.
Exercise: Your body should be completely straight from the shoulder to the knee throughout the exercise. Lean forward as far as you can, controlling the movement with your forearms and your distal shoulder. When you can no longer hold the position, gently take your weight on your hands, lifting your chest and pull-up position. Complete a minimum of 10 repetitions on each side. **2 sets.**



9 HAMSTRINGS INTERMEDIATE

Starting position: Crawl on a soft surface. Ask your partner to hold your ankles from behind.
Exercise: Your body should be completely straight from the shoulder to the knee throughout the exercise. Lean forward as far as you can, controlling the movement with your forearms and your distal shoulder. When you can no longer hold the position, gently take your weight on your hands, lifting your chest and pull-up position. Complete a minimum of 10 repetitions on each side. **2 sets.**



9 HAMSTRINGS ADVANCED

Starting position: Crawl on a soft surface. Ask your partner to hold your ankles from behind.
Exercise: Your body should be completely straight from the shoulder to the knee throughout the exercise. Lean forward as far as you can, controlling the movement with your forearms and your distal shoulder. When you can no longer hold the position, gently take your weight on your hands, lifting your chest and pull-up position. Complete a minimum of 10 repetitions on each side. **2 sets.**



10 SINGLE-LEG STANCE HOLD THE BALL

Starting position: Stand on one leg.
Exercise: Balance on one leg while holding the ball with both hands. Keep your body upright on the ball of your foot. Remember to lift your knees back to neutral. Hold for 30 sec. Change leg and repeat. The exercise can be made more difficult by passing the ball around your waist angle under your other knee. **2 sets.**



10 SINGLE-LEG STANCE THROWING BALL WITH PARTNER

Starting position: Stand 2-3 m apart from your partner, with each of you standing on one leg.
Exercise: Keeping your balance, and with your stomach held in, throw the ball over your shoulder. Keep your weight on the ball of your foot. Remember, keep your knees and thighs flexed and try to hold a back muscle. Repeat for 30 sec. Change leg and repeat. **2 sets.**



10 SINGLE-LEG STANCE TEST YOUR PARTNER

Starting position: Stand on one leg, support your partner and at arm's length.
Exercise: While you both try to keep your balance, each of you in turn tries to push the other off balance or off the ground. Try to keep your weight on the ball of your foot and prevent your knee from buckling backwards. Continue for 30 sec. Change leg and repeat. **2 sets.**



11 SQUATS WITH TOE RAISE

Starting position: Stand with your feet hip-width apart. Place your hands on your hips if you like.
Exercise: Imagine that you are about to sit down on a chair. Perform squats by bending your hips and knees to 90 degrees. Do not let your knees buckle inwards. Always ensure that squats are done quickly. When your feet are completely straight, stand on your toes then slowly lower down again. Repeat the exercise for 20-30 sec. **2 sets.**



11 SQUATS WALKING LUNGES

Starting position: Stand with your feet hip-width apart. Place your hands on your hips if you like.
Exercise: Lunge forward slowly at an even pace. As you lunge, bend your leading leg until your hip and knee are flexed to 90 degrees. Do not let your knee buckle inwards. Try to keep your upper body and hips steady. Repeat a lunge on each side. Repeat the exercise for 30 sec. **2 sets.**



11 SQUATS ONE-LEG SQUATS

Starting position: Stand on one leg, slowly holding onto your partner.
Exercise: Slowly bend your knee as far as you can manage. Concentrate on preventing your knee from buckling inwards. Bend your knee slowly then straighten it slightly more quickly, keeping your hips and upper body in line. Repeat the exercise 10 times on each leg. **2 sets.**



12 JUMPING VERTICAL JUMPS

Starting position: Stand with your feet hip-width apart. Place your hands on your hips if you like.
Exercise: Imagine that you are about to sit down on a chair. Bend your hip and knee to 90 degrees, and hold for 2 sec. Do not let your knees buckle inwards. From the knee position, jump as high as you can and lift up or the ball of your foot with your feet and knees slightly bent. Repeat the exercise for 30 sec. **2 sets.**



12 JUMPING LATERAL JUMPS

Starting position: Stand on one leg with your other foot bent slightly forward from the lead, with knees and hips slightly bent.
Exercise: Using squats, it is a lunge then the supporting leg on to the lead leg. Lift your leg on the ball of your foot. Bend your hip and knee slightly as you land. Repeat the exercise until you reach the other side of the patch, then jump back to recover. **2 sets.**



12 JUMPING BOX JUMPS

Starting position: Stand on one leg with your foot hip-width apart. Imagine that there is a small platform on the ground and you are standing on the middle of it.
Exercise: Jump up quickly, landing on the platform. Land on your toes. Land on the platform and diagonally across the foot. Bend your hip and knee slightly as you land. Repeat the exercise until you reach the other side of the patch, then jump back to recover. **2 sets.**

PART 3 RUNNING EXERCISES - 2 MINUTES



13 RUNNING ACROSS THE PITCH

Run across the pitch, from one side to the other, at 75-80% maximum pace. **2 sets.**



14 RUNNING BOUNDING

Run with high bounding steps with a high knee lift, landing gently on the ball of your foot. Use an exaggerated pace for each step (step, arm and leg). Try to lift your leading leg over the rest of your body as your knees buckle inwards. Repeat the exercise until you reach the other side of the pitch, then jump back to recover. **2 sets.**



15 RUNNING PLANT & CUT

Run 4-5 steps, then plant on the outside leg and cut to change direction. Accelerate and sprint 5-7 steps at high speed (80-90%), maintain pace before you decelerate and take a new path. Do not let your knees buckle inwards. Repeat the exercise until you reach the other side of the pitch, then jump back to recover. **2 sets.**



Public Health at the Olympics

- Heat exhaustion; Dehydration (Paris summers 95 F); lack of AC in dorms
- Infectious Disease: IOC followed guidelines from public health organizations – digital health passports, real time health monitoring systems – “public health playbooks”
- Concerns about Covid (40+ cases), Measles, Dengue Fever, Leptospirosis
- Pollution of the Seine River. Since 2015 the French government has spent 1.53 billion to clean it up. (People have been banned from swimming there since 1923 due to pollution and river traffic)
- River pollution levels exceeded safety limits on most days between Jul 26 and Aug 7. (Water utility Eau de Paris)

Swimming/triathlon races in the Seine River



Swimming/triathlon races in the Seine River

- Belgian team withdrew from triathlon mixed team finals – athlete Claire Michel contracted *E. coli* after her individual races
- Portuguese triathlete Vasco Vilaca –symptoms of GI infection after the race
- German swimmer Leonie Beck was ill after her race
- Heavy rains returned high levels of bacteria to the Seine – 900 CFU/100 m; canceled several practices and postponed some races



Unusual Genetic Disease in Olympic Athletes Katy Ledecky



Postural Orthostatic Tachycardia Syndrome (POTS)

- Circulatory disorder that affects the autonomic nervous system
- Abnormal increase in heart rate when standing or sitting up (blood pools in lower part of body)
- Lightheadedness, fainting, headache weakness, fatigue, shaking, sweating heart palpitations, chest pain
- Triggers – pregnancy, major surgery, trauma, viral illness
- Most common in women 15-50; affects 1 – 3 million people in US
- Runs in families; no definitive disease-causing gene yet

Symptoms & Triggers for POTS

POTS: Genes, Symptoms and Natural Solutions

POTS Symptoms

- Fatigue
- Headaches
- Brain fog
- Lightheaded, fainting
- Vertigo
- Heart palpitations
- Chest pain
- Exercise intolerance
- Shaking
- Cold hands and feet
- Abdominal pain, nausea, bloating, diarrhea, constipation, bladder problems



Diseases and conditions linked to triggering POTS include:

- Autoimmune activation of the adrenergic system
- Autoimmune activation of the angiotensin II type 1 receptor
- Mast cell activation
- Viral illness, infections
- Joint hypermobility (found in about 50% of teens with POTS), Ehlers-Danlos
- linked to the HPV vaccine (more studies are needed on this to show causality)
- Concussions
- Inflammatory disorders

Genes linked to POTS

SLC6A2 gene: codes for a **norepinephrine transporter (NET)**, NET impairment is linked to depression, panic disorder, tachycardia, and POTS.

GNB3 gene: codes for a subunit of a G-protein. Variants causes “enhanced vagal withdrawal of the heart” in relation to POTS.

NOS3 gene: codes for endothelial nitric oxide (NO) synthase enzyme, which is essential for **relaxing blood vessels**. Variants to NOS3 are linked to POTS.

POTS treatment

- Increase fluid intake (2-2.5 L/day)
- Increase salt intake
- Moderate exercise –rowing machines, recumbent bikes, swimming, increase to tolerance
- Lifestyle changes –small meals, compression socks
- Meds – steroids, SSRIs



Kidney Disease – Suni Lee

- 2023 Diagnosis
- Incurable kidney disease
- Abnormal swelling in face, hands, legs ankles
- Family history of kidney disease –brother died at 45, mother at 60
- Left college; returned to gymnastics in early 2024 and to the Olympics in Paris



| PRESS RELEASE

**American Kidney Fund
Teams Up with Gymnastics
Champion Suni Lee to
Help Educate and Empower
People to Know the Cause
of Their Kidney Disease**

 American Kidney Fund®
FIGHTING ON ALL FRONTS



Physical disability

- Nearly 1 in 5 people worldwide lives with a disability
- People with disabilities are at inherent risk for low engagement with a consequential increased risk for chronic disease related to a sedentary lifestyle: cardiometabolic disease and mental health conditions.
- Persons with a disability are 16%–62% less likely to meet physical activity guidelines

Health in Paralympic Athletes

Paris, August 2024

- Para Athletes –athletes with disabilities who play sport
 - Visual impairment
 - Physical impairment: 1. Neurological (Brain, spinal cord, neuromuscular); 2. Musculoskeletal disorders (limbs, short stature, leg length difference, impaired passive ROM)
 - Intellectual impairment
- Impairments pose challenges in sport and daily living Static or progress over time
- Often older, comorbidities, multiple impairments
- Often have pain
- Higher risk of injury, infections (respiratory, skin, GI); SC injuries – UTI
- Lack of data about mental health - burnout, anxiety, depression, dealing with stereotypes

Paralympians

- More prone to illness & injury than their Olympic counterparts.
- No international standardized periodic health evaluations as there are for Olympics
- Medical support teams important; logistics – arrival, adjustment implement ‘buddy’ system



Barriers to Para Sport Participation

Poor knowledge of Para Sport

Lack of social support

Poor accessibility to training facilities

Lack of equipment

Devaluation of para sports

Inequity in financial support



Goal: Health Equity for People With Disabilities



Benefits of Para Sport Participation

Cardiometabolic Health

Strength

Functional status

Adaptive skills

Brain Health

Social inclusion

“Golden Couple of Paris 2024” Tara Davis & Hunter Woodhall



The End Questions?





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