



# Sports Hematology

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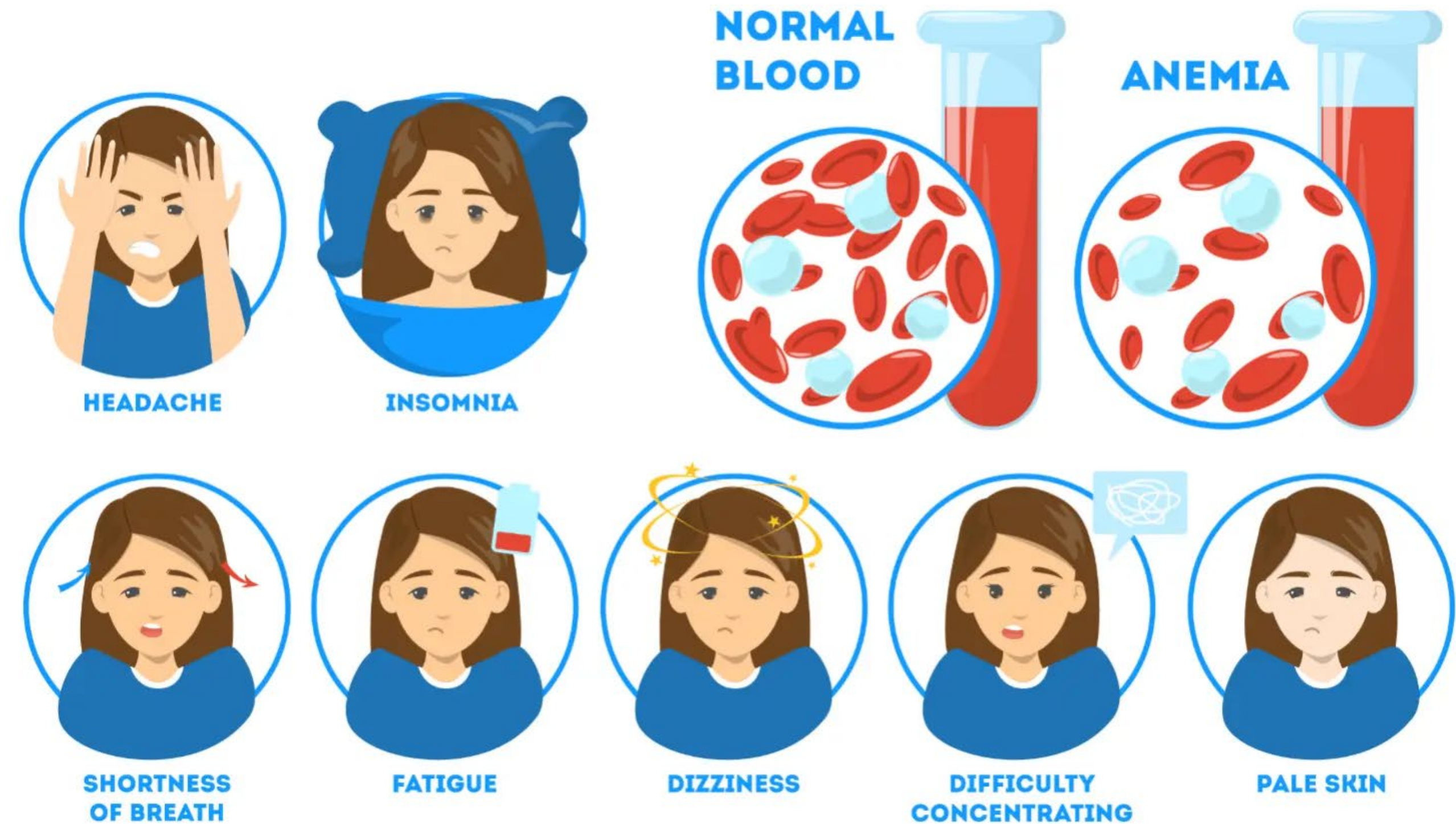
# Objectives

- Understand the role of blood disorders in sports
- Address possible treatments for blood disorder
- Discuss symptoms and screenings

# Anemia

- Iron deficiency
- Thalassemia
- Vitamin deficiency
- Blood loss
- Pseudoanemia

## ANEMIA SYMPTOMS



# Anemia (continued)

- Hgb based on age, sex of the patient, altitude, prevalence of smoking
- Decreases with age
- Decreases with pregnancy
- Increases from smoking, living in high altitude, dehydration and certain meds such as testosterone
- Based on hemoglobin, HCT and RBC counts (normal range based on 95% of population)
- **Females** – Hemoglobin <11.5 g/dL (119 g/L) or hematocrit <35 percent
- **Males** – Hemoglobin <13.5 g/dL (136 g/L) or hematocrit <40 percent

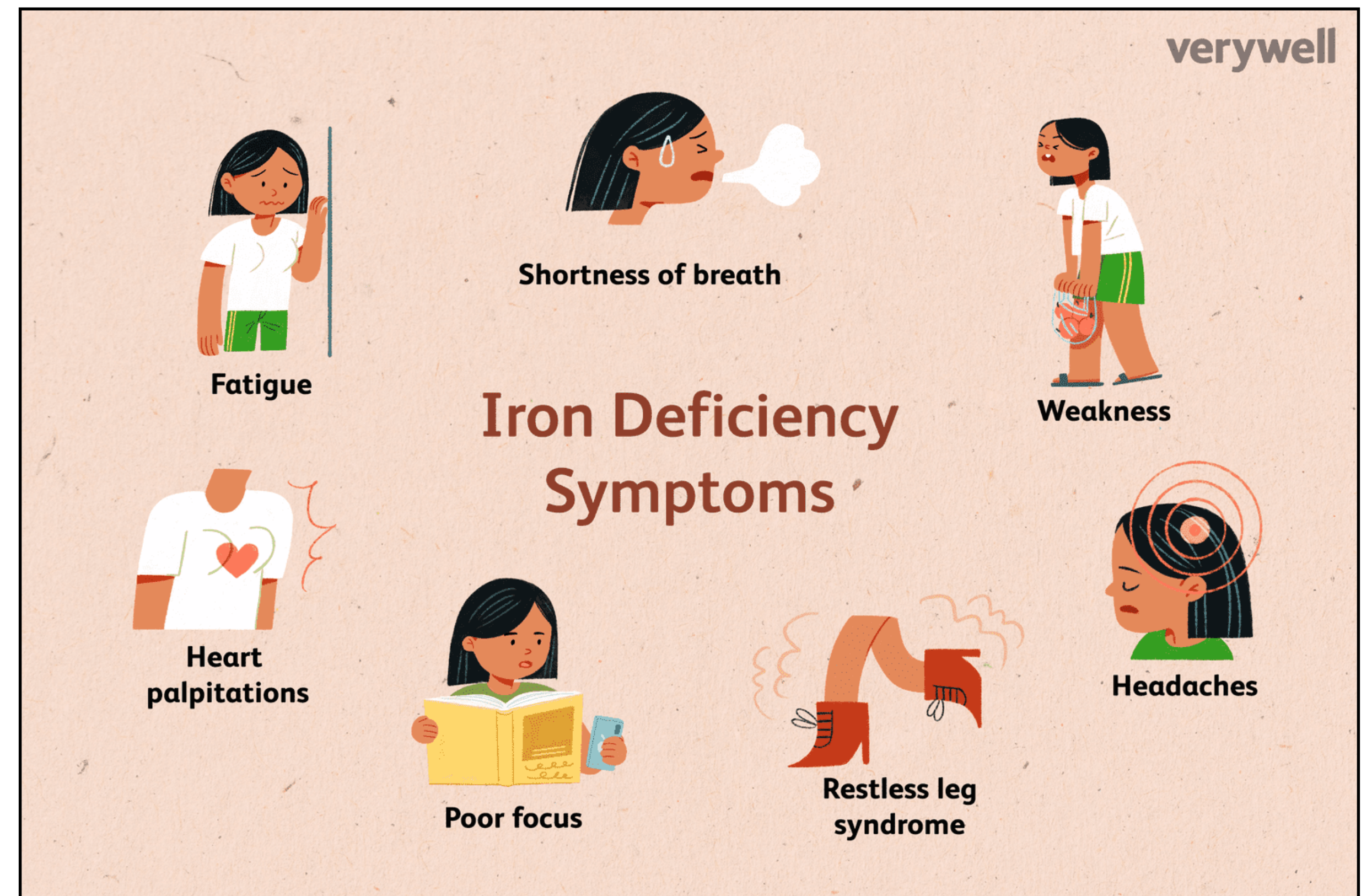
# Iron Deficiency

- Blood loss (GI loss, menstrual loss, etc.)
- Malabsorption (diet, bariatric surgery, celiac disease, gastritis)
- Athletes, also with some iron loss in sweat, traumatic hemolysis
- Anemia symptoms plus pica, restless legs
- Check iron stores (ferritin, TIBC, transferrin saturation, etc.)
- Oral and IV repletion

# Iron Deficiency

## Symptoms

- Restless leg
- Hair loss
- Pica
- Fatigue
- Treated with diet, oral, or IV repletion



# SOURCES OF *Iron*



POULTRY

FISH



LENTILS



OYSTERS



LIVER



PORK

BEEF



SARDINES



MOLASSES



CHICKPEAS



SPINACH



EGGS

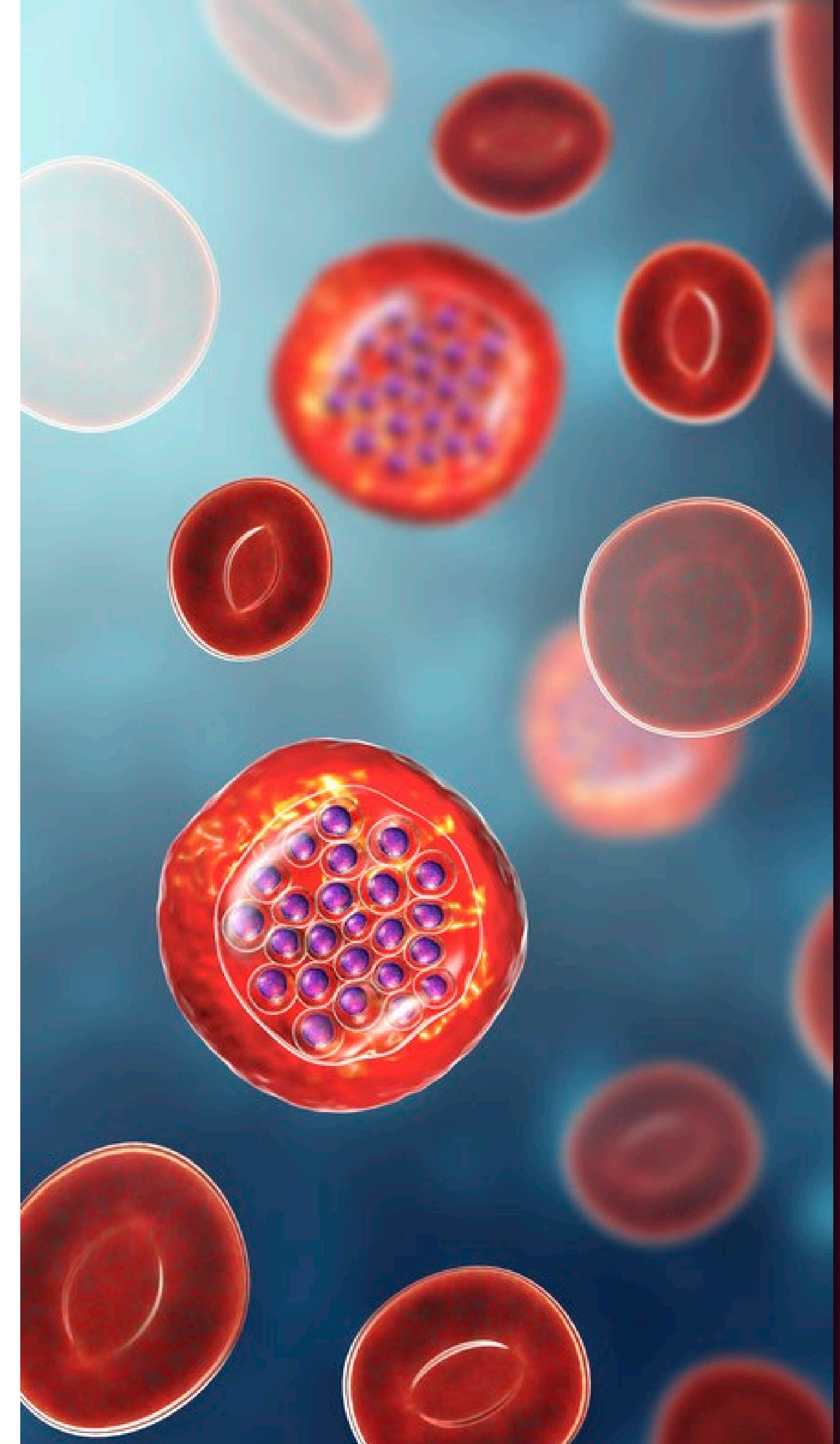


PUMPKIN SEEDS



# Thalassemia

- Inherited hemoglobin abnormality in alpha or beta chain associated with anemia
- Most likely carriers or minor anemia if diagnosed later
- Normal ratio of alpha globin to beta globin production is disrupted due to a genetic variant
- Abnormal chains tend to precipitate, leading to destruction of red blood cell (RBC) precursors in the bone marrow (ineffective erythropoiesis) and in the circulation (hemolysis)
- Arose in certain regions of the world (sub-Saharan Africa, the Asian-Indian subcontinent, Southeast Asia, Mediterranean region) in which malaria is/was endemic as protective of malaria
- 4 alpha globin genes (loss of need at least 2 genes lost to be symptomatic with minima disease, otherwise carrier). Worse outcomes with more loss.
- There are two beta globin genes and can have combination of regular bet, beta+, or beta 0 genes and characterized as transfusion dependent or not and beta thal minor is often a heterozygous carrier



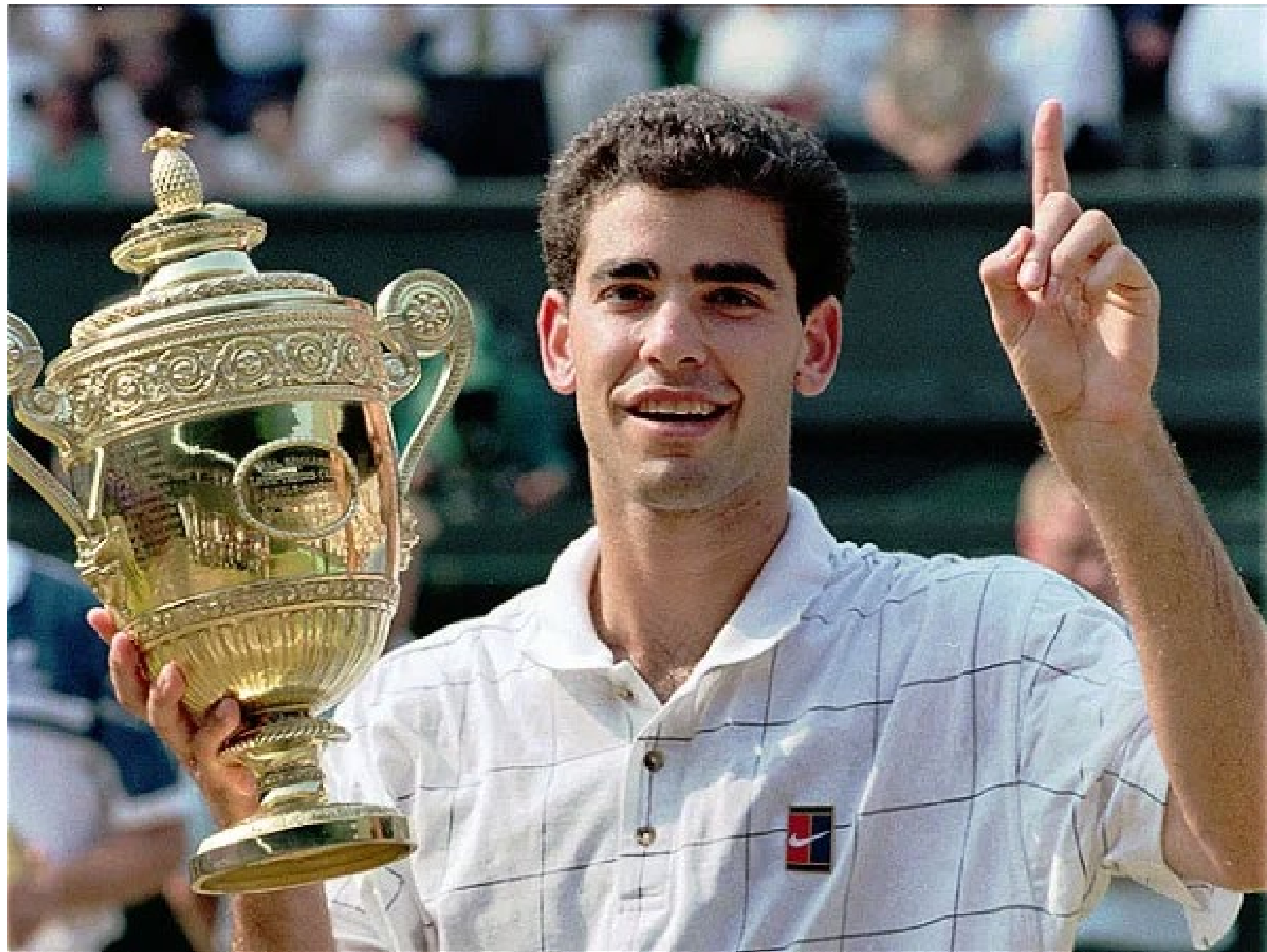


# Thalassemia

- Can be asymptomatic carrier status or have severe anemia, extramedullary hematopoiesis, skeletal and growth deficits, and iron overload
- Send hemoglobin electrophoresis and global gene testing
- Check iron levels in minor cases, may not impede activity
- Reproductive counseling and testing



# Professional Athletes with Thalassemia



# Vitamin Deficiency

- B12 from malabsorption (IBD, surgery, celiac disease, gastritis)
- Vegan/vegetarian diet, eating disorders
- Folate deficiency from EtOH, drugs, hemolysis, malabsorption
- PO folate repletion
- IM or PO B12 pending cause



## Foods High in Folate



Fortified bread, cereals and rice



Beans

Orange juice

Spinach

# Blood Loss

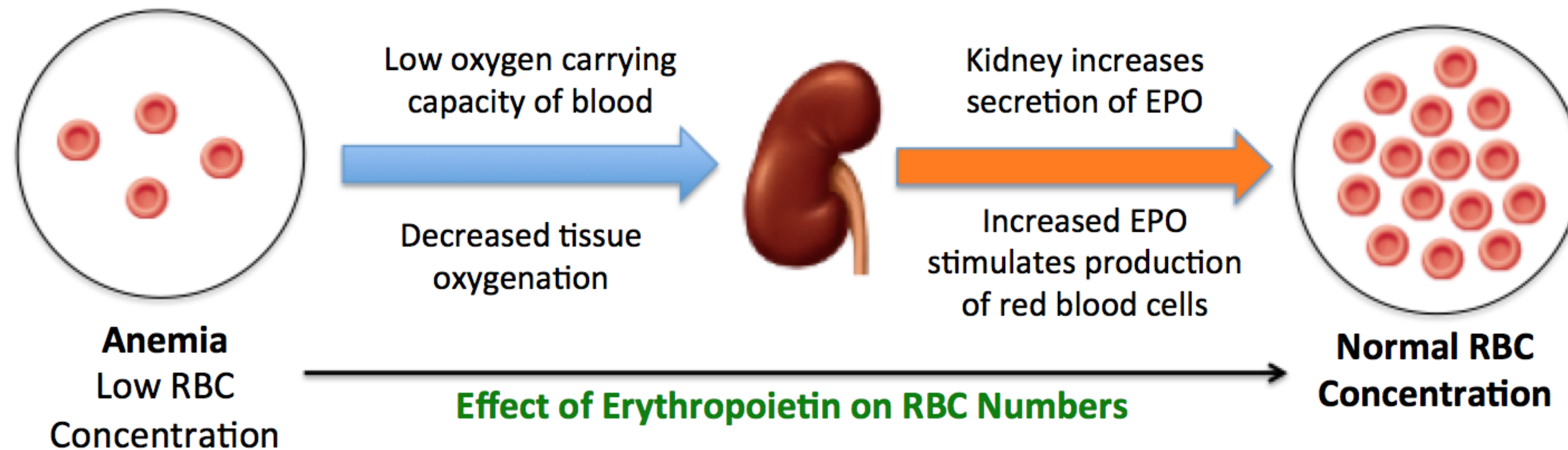
- Menstruation
- “Foot strike”- damage to RBC in the feet due to running on hard surfaces with poor quality shoes leads to iron loss
- Heavy sweating iron loss
- IBD (Crohn’s ulcerative colitis)
- Malabsorption (gastric surgery, zinc supplements affecting copper, eating disorders)

# Pseudoanemia

- Blood plasma volume is lowered by sweating, the production of metabolites and an increase in arterial pressure
- The body adapts to these changes by conserving water and salt between bouts of exercise
- This results in an increase in the base plasma volume, diluting the red blood cells and decreasing the hemoglobin concentration
- Regular physical training leads to an increase of plasma volume by 10-20 percent
- No treatment needed

# Blood Doping

- Erythropoietin - hormone normally made by kidneys, stimulates red blood cell production
- Desmopressin (antidiuretic hormone) used to mask Epo use by increasing water resorption
- Mannitol, dextran, albumin, and hydroxyethyl starch also expand plasma
- Side effects: MI, DVT, HA, HTN



# Altitude training

- Training for several weeks at high altitude, preferably over 2,400 meters (8,000 ft.) above sea level, though more commonly at intermediate altitudes due to the shortage of suitable high-altitude locations
- The body may acclimate to the low oxygen in one or more ways such as increasing the mass of RBCs and hgb, or altering muscle metabolism
- Simulators also used





# Testosterone Effects

Intramuscular  
Testosterone  
Injection



- “Anabolic steroids”
- Normal side effects: cardiac hypertrophy, cholesterol changes, gynecomastia, hypogonadism on withdrawal
- Hematology: erythrocytosis, blood clots

# Sickle Cell Trait

- One copy of sickle trait, typically benign
- Genetic counseling
- Splenic infarction - high altitudes, mountain climbing, unpressurized airplanes
- Increased clot risk
- Rhabdomyolysis - muscle necrosis and the release of intracellular muscle constituents into the circulation causing AKI, compartment syndrome, electrolytes changes, arrhythmia
  - Increased with heat exposure, dehydration, myocardial ischemia and arrhythmias



# Venous Thromboembolism

- Life-threatening issue that comes from veins (usually in leg) and can move to lungs
- Risks: Alterations in blood flow (i.e. stasis), vascular endothelial injury, alterations in the constituents of the blood (i.e. inherited or acquired hypercoagulable state)
- COVID-19
- Treatment with blood thinners
- In athletes, injuries, travel, dehydration and surgery are all risks



# Risks of Blood Thinners

- GI bleed
- Menstrual bleed
- Traumatic or spontaneous bleed
- ICH
- Epistaxis
- Difficult to reverse depending on medication



# Hemophilia

- Hemophilia A (factor VIII [factor 8] deficiency) and hemophilia B (factor IX [factor 9] deficiency)
- X-linked inherited coagulation factor deficiencies that result in lifelong bleeding disorders
- Family history
- Bleeding, bruising without trauma



# Hemophilia

- The National Hemophilia Foundation (NHF) recommends athletes with a bleeding disorder participate primarily in safe and moderately risky sports
- Regarding protective gear, splints, and prophylactic factor infusions timed around the activities should be initiated early
- Avoid NSAIDs
- Primary and secondary prophylaxis with Factor VIII or IX with factor replacement
- DDAVP for hemophilia A
- Emicizumab- monoclonal AB for factor IX and X- creates scaffold to replace FVIII and promote FIX binding (not for acute bleed)
- Need to discuss with hemophilia specialist

Low impact sports	Moderate impact sports	High impact sports
Aquatics	Aerobics	BMX racing
Fishing	Basketball	Boxing
Frisbee	Horseback riding	Football (American)
Golf	Racquetball or tennis	Lacrosse
Hiking	Running/jogging	Rodeo
Walking	Soccer (world football)	Rugby

# Questions?

**Thanks!**