Pre-exercise Screening

Pre-exercise screening	
Evidence based system identifying + managing health risks for exercise. 3 stages	
Stage 1	Identify individuals w/ known diseases, signs/symptoms disease who may be at risk adverse events during exercise. Self-administered questionnaire
Stage 2	Administered by health professional, identifies individuals w/ risk factors/ conditions to assist correct exercise prescription . measures family history, smoking status etc
Stage 3	Administered by health professional, used to calculate risk factor, measures things like BMI, BP etc
Risk factors	Age, smoking status, family history, physical inactivity, other (BP, BMI, cholesterol, blood sugar) If overall score less 2= low risk= continue exercise

Exercise intensity guidelines			
Intensity	**HR**	**Perceived exertion RPE**	**Description**
Sedentary	<40% max	RPE <1	Sitting/lying, little movement
Light	40 <55% max	RPE 1-2	Aerobic activity causing no change breathing rate, intensity sustain 60 min
Moderate	55 < 70% max	RPE 3-4	Aerobic activity has convo without un-interruption, intensity between 30-60 min
Vigorous	70 < 90% max	RPE 5-6	Aerobic activity convo cannot be maintained, intensity sustained up to 30 min
High	➢ 90% max	RPE > 7	Intensity cannot be maintained longer than 10 minutes

Skeletal muscle: structure and function

Functions	Force production for movement+ breathing + postural support. Heat production, endocrine role
Connective tissue	**Epimysium:** surrounds entire muscle **Perimysium:** surrounds bundles of muscle fibers **Endomysium:** surrounds individual muscle fibers **Sarcolemma:** muscle cell membrane
Satellite cells	role muscle growth + repair (increase # nuclei in damaged fiber). More nuceli= bigger size= hypertrophy

Microstructure skeletal muscle	
Muscle fiber	Long cylindrical cell containing sarcoplasm, myofibrils
Z disc	Anchor thin filaments, separate one sarcomere from next

a-band	Thick filaments
I band	Made actin, z line passes through middle
M line	Protein structure holds thick filaments together at centre sarcomere

Neuromuscular junction
Gap between motor neuron + muscle fiber, site where actin + myosin interaction occurs
Sarcoplasmic reticulum + transverse tubules
SR houses calcium + transverse tubules= tubes allow travelling AP to contract/relax muscle fibers

Sliding filament model
Muscle shortening= movement actin filament over myosin forming cross bridges between the 2 filaments= reduces distance between z-lines of sarcomere

Relationship between troponin, tropomyosin, myosin and calcium
Calcium= needed to bind + move troponin away from myosin Hydrogen ions can impede calcium binding process by competing for site of binding= myosin can't attach = loss of power/no contraction
Energy for muscle contraction
ATP required for muscles to contract, myosin ATPase breaks down ATP as fibers contract producing ADP + phosphate
Sources ATP for contraction
Phosphocreatine (stored muscle), glycolysis (breakdown glycogen stored in liver), oxidative phosphorylation (breakdown carbs fats proteins).

Muscle excitation, contraction and relaxation	
Excitation	Nerve impulse arrives NMJ travels down transverse tubules to SR
Contraction	AP reaches SR, calcium is released + diffuses into troponin Tropomyosin removed from active sites on actin, cross bridge of myosin + actin formed
Relaxation	Absences nerve impulse NMJ= ca2+ pump removes calcium back to SR= tropomyosin moves and covers actin, cross bridge formation ceases

Muscle fatigue
Decline in power output. At high intensity= accumulation hydrogen ions= diminished corss bridges= cannot maintain power output Low intensity/long durations= accumulation free radicaled, electrolyte imbalances, glycogen depletion
Exercise related muscle cramps
Spasmodic involuntary contractions. 2 possible causes: Electrolyte depletion Neuromuscular control theory= afferent signals do not come back to tell muscles to relax= continuous contractions= spasms

Characteristics muscle fibers	
Biomechanical properties:	Oxidative capacity= # capillaries surrounding muscle fibre, # mitochondria, # myoglobin Type myosin ATPase= regulates speed of ATP degeneration i.e. type 1= break down is dlow
Contractile properties:	Maximal force production, speed of contraction, muscle fiber efficiency
How are skeletal muscle fibers typed	
Muscle biopsy: Small piece tissue removed, then is stained for type of myosin ATPase (T1= darkest colour).	
Characteristics individual fibers	
Shifts in fiber type may occur, resistance training increase amount Type 2 X and reduce type 1. Detraining can reduce % type 1	
Type 1	Slow twitch, slow oxidative
Type 2 A	Intermediate fibers, fast-oxidative glycolytic fibers
Type 2 X	Fast twitch, fast glycolytic fibers

Muscle actions	
Isometric	Exerting force withour chaning muscle length
Isotonic **Concentric** **Eccentric**	 Shortening of muscle (bicep in bicep curl) Lengthening of muscle during movement (tricep in bicep curl)

Speed of muscle actions	
Twitch	Single stimulus, time phases vary among people
Latent period	1st stage, lasts approx 5ms
Contraction	2nd phase, lasts 40ms
Relaxation	Final phase, lasts 50ms
Speed shortening greater in fast fibers= SR releases Ca++ at faster rate + highers ATPase activity in comparison	

Force regulation in muscle	
#/type motor units	More units recruited- greater force. Fast fibers exert greater specific force then slow
Initial length	Ideal length for force, 60% lengthening greater force then 100% stretched
Natural stimulation	3 stimulations: simple, summation and tetanus Simple= first few contractions Summation= increase neural stimulation decreasing relaxation period Tetanus= further increase stimuli, individual contractions blended into 1 sustained contraction

Contractile history	If muscle first performs bouts of fatiguing movements= subsequent muscle force decreased

Force-velocity relationship
Force exerted by muscle, velocity is greater in muscle containing higher % fast fibers
Force power relationship
Peak power generated greater in muscle that contains high % fast fibers. Increases with velocities of movement up to 200-300 degrees/ second

Diseases + ageing on muscle function
Aging associated w/ muscle loss + mass. Aging also results loss fast fibers, they take on type 1 characteristics instead Diabetes, cancer, muscular dystrophy all related with decrease muscle mass