Work Physiology CMPE 233: Human Factors Started in 1913 by Max Rubner in Berlin. Discipline grew in an effort to understand where humans could operate. > War (especially cold war) was the primary motivator. > At one time both were studied together...differences in physiological demand caused the two to disciplines to separate. Workers rarely exceed 30 to 40% of their maximum aerobic capacity. Athletes regularly exceed these rates. Today, more exercise physiology research. Work Physiology and Biomechanics Simple, infrequent lifting produces mechanical forces --Carrying, repetitive lifting, & walking create physiological demands. Carrying, repetitive lifting, and walking can exceed the anaerobic energy stores. Aerobic Process Maximum Aerobic Capacity Continuous muscle contractions are supported by the aerobic Can be assessed by: process where carbohydrates and/or fat are oxidized in the Running on a treadmill presence of O_2 . For each liter of O₂, about 5 kcal of energy are generated (note: 1 gallon of gasoline = 31M calories or 31,000 Calories) Exercising on a cycle ergometer Step test NIOSH limits aerobic work to 9.5 kcal/min

- A limit of 70% of maximum aerobic capacity for arm work.
- Limits of 50%, 40%, and 33% of maximum aerobic capacity for 1 hour, 1 to 2 hour, and 2 to 8 hour work.
- We can estimate maximum aerobic capacity based on the relationship between heart rate and oxygen consumption.
- Assuming: linearity of heart rate oxygen consumption relationship



Factors Affecting Aerobic Output

- Training adaptation
- Sex & Age
- Anthropometry
- Nutrition
- Psychological factors
- Type of work
- Work duration
- Technique
- Environment



 Expired air is collected and measured for volume and O₂ content.





Biomechanics

The study of internal and external forces acting on the body segments, and the effects produced by these forces.

► The principles of engineering, specifically mechanics, applied to human movement.



Areas of Biomechanics Definitions Kinematics: study of the variables that describe or Sports Biomechanics quantify motion Study the most optimal way to move the body in order to Displacement achieve maximal performance, whilst minimizing risk of Velocity injury Acceleration Occupational Biomechanics Kinetics – study of the variables that cause or influence motion To design machines and the workplace to reduce repetitive stress on workers' joints Forces Torques Clinical Biomechanics Mass Analyzes the mechanics of injured patients and provide Biomechanists use the principles of mechanics in the feedback (biofeedback) to restore normal function analysis of human movement to answer: Military Biomechanics 1. How can human performance be enhanced? To design equipment to reduce risk of hazard associated. 2. How can injuries be prevented? with biomechanical injuries 3. How can rehabilitation from injury be expedited? FREEP A A. J. J. J. SPECIAL US HANDLES LONG ENOUGH



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