Analysis of Human Performance

PED 303-01

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Time: 9:30 MTW F
Location: Wh 111
Instructor: J. Grant White
Office: Wh 312
Ext: 1350
E-Mail: gwhite@northland.edu
Final Exam: Thursday, 4/18/06, 8:00 a.m.-10:00 a.m.


Website: Exercise Physiology: The Methods and Mechanisms Underlying Performance http://home.hia.no/~stephens/exphys.htm

On-Line Course Syllabus: www.northland.edu/oe --Course Descriptions--Analysis of Human Performance

Please note: Students in need of academic or medical accommodation should contact Judi Holevatz, R.N., @ ext. 1340, Rm. 206 of the Ponzo Center.

Course Overview

This course combines the two dissimilar disciplines of Exercise Physiology and Biomechanics that share the characteristic of helping to explain the workings of the human body while in motion. Exercise physiology deals with the reactions and adaptations of human internal systems to the stimulation of exercise. The field of Biomechanics results when principles of mechanical physics are applied to human motion. This course will offer the student the opportunity to develop concepts based on fundamental scientific principles in each area and to apply them to meaningful, real life situations.

Your instructor believes that each academic discipline develops its own system of thought, which is the basis for understanding all existing information and synthesizing new ideas in that field. More than anything else, it is his wish to use the information and ideas presented in this course to foster an understanding among his students of the system of thought in this particular subject area. While retention of the specific information presented in this class will be short term (unless it is reinforced by frequent use), the concepts and ideas that constitute the “system of thought” will persist and will enable the student to recover the forgotten specifics, explore and understand other related information, and to remain current, active, and creative in this field.
The instructor will attempt at all times to help students to develop concepts from the information taught, and to relate the material to familiar life experiences and to future applications in a vocational setting.

It is imperative that students understand that this information is truly alive and useful and does not merely represent an attempt on the part of the college to make their lives difficult. Mastery of this material will help students to analyze motion, diagnose movement and technique errors, manipulate a variety of physiological and mechanical variables in adapting activities for participants with mixed abilities, incorporate scientifically sound principles into training, performance, and technique, and become intelligent and informed consumers of the professional and popular literature in this field.

**Outcomes**

Upon completion of this course, students will have developed a:

- Functional (conceptual) understanding the food fuel and bioenergetics
- Functional (conceptual) understanding of energy metabolism:
  - how it changes in response to changes in exercise intensity
  - how it can be targeted in interval training
  - how it can be enhanced through other specific training methodologies
- Functional (conceptual) understanding of the physiology of muscular contraction, muscle fiber types, their recruitment, and response to training
- Functional (conceptual) understanding of the Vestibular and Kinesthetic receptors and their functions in:
  - monitoring movement
  - facilitation/inhibition of contraction
  - performance contexts
  - plyometric training methods

**The Course Progression**

What follows should be understood to represent a general progression of the class. Content and timing will vary according to the needs and interests of the class.

**Week 1**
Course intro./overview; food fuels--carbohydrate, protein, fat, and their effects on health, performance, and body composition

Read chaps. 1 & 2 MK&K

Week 2
Food fuels continued

Read chap. 3 MK&K

Week 3
Finish food fuels, energy overview, introduce energy transfer

Read chaps. 4 & 5 MK&K

**Week 4**
Metabolic pathways for energy transfer

Read chaps. 6 & 7 MK&K

**Week 5**
Aerobic and anaerobic work, energy metabolism and exercise

Read chaps. 8 & 9 MK&K,
Maximal Oxygen Consumption- The VO2 MAX  [http://home.hia.no/~stephens/vo2max.htm]

**Week 6**
"Oxygen dept" and recovery from exercise

Read chaps. 10 & 11 MK&K,
The Lactate Threshold  [http://home.hia.no/~stephens/lacthres.htm],
Efficiency and Endurance Performance  [http://home.hia.no/~stephens/effiperf.htm]

**Week 7**
Interval training and aerobic conditioning methods

Read chap. 21 MK&K,
Principles of Training- Revisited  [http://home.hia.no/~stephens/traprin.htm],
Understanding Intervals: Matching training characteristics to physiological changes  [http://home.hia.no/~stephens/interval.htm],
The effects of age and exercise on short term maximal performance: A model based on physiological systems  [http://home.hia.no/~stephens/maxpower.htm],
Myocardial Adaptations to Training  [http://home.hia.no/~stephens/hrchngs.htm],
Understanding Heart Rate and Exercise  [http://home.hia.no/~stephens/hrchngs.htm],
The Time Course of Training Adaptations  [http://home.hia.no/~stephens/timecors.htm]

**Week 8**
Muscle structure and function from gross to microscopic (physiology of contraction), fiber type, implications of fiber type on performance

Read chap. 18 MK&K,
Basic Skeletal Muscle Physiology  [http://home.hia.no/~stephens/musfacts.htm],
Skeletal Muscle Fiber Type  [http://home.hia.no/~stephens/fibtype.htm]

**Week 9**
Training muscles for strength

Read chap. 22 MK&K,
Training Adaptations in Skeletal Muscle  [http://home.hia.no/~stephens/mustrn.htm],
Aging Effects on Skeletal Muscle  [http://home.hia.no/~stephens/musage.htm]

**Week 10**
Overview of the Nervous System, overview of the physiology of nerve transmission, the interaction between the nervous and muscular systems

Read chap. 19 MK&K,
The Brain-Body Link and Adaptation to Training  [http://home.hia.no/~stephens/brnbody.htm]

**Week 11**
Kinesthetic and Vestibular Systems

Read pp. 101-120 H&K

**Week 12**
Basic Biomechanics terminology and concepts

**Week 13**
Concepts of motion, types, displacement/distance, speed/velocity, acceleration, trajectories

**Week 14**
Linear motion, Newton’s laws, forces and their effects

**Lecture Exams**
Lecture exams will take the form of a series of guided investigations (take-home exams) the nature of which will be explained in class. The pervasive theme will be application of the information in question to solve problems that are practical and relevant to the future work and play of the students in the class.

**Grading**

Grades in this class will be calculated on a straight percentage basis. This is accomplished by dividing the number of points earned by the total number of points possible. I do not grade on improvement except to the extent that improved scores will bolster the student’s overall point total. Full and enthusiastic class participation is expected of all students and should not be viewed as something extra that can be counted on to compensate for poor performance on written assignments.

The grading scale is as follows: 93-100 A; 90-92 A-; 87-89 B+; 83-86 B; 80-82 B-; 77-79 C+; 73-76 C; 70-72 C-; 67-69 D+; 60-66 D; 0-59 F.

**Attendance**

Due to increasing problems with inattendance, it has become necessary to restate and reassert the attendance policy for this class. Understand that a grade in a class, in effect, certifies that the student has been exposed to the curriculum as described in the syllabus, has participated in all activities associated with the class, and has completed all assignments to a degree reflected in the final grade. In other words, **you must attend the class, in order to pass the class!**

That being said, the policy for attendance and late assignments with respect to grading is as follows:

Attendance in this class **does count** with 1 point being deducted from your **final** point total for each hour of unexcused absence. Excused absences include such things as illness, certain family obligations, and certain school sponsored activities and trips. Studying for an exam for another class is not an excused absence on the basis of it being a school sponsored activity. Misses can be made up by writing and submitting a paper which covers the material covered in class on the day in question. **Under no circumstances should a student assume that by merely submitting a paper, they have made up for 100% of the class missed.** In order to be considered equivalent, the paper must be of adequate length, substance, and quality based on the judgment of the course professor. For purposes of calculating a final grade for the class, the one point deduction for the absence will be thrown out if a paper is submitted. The paper will be graded, and the grade averaged with the scores on all other written work. Therefore, the degree to which the paper actually substitutes for the class experiences on the day missed will be directly reflected in the final grade.

Because this professor has had students run a doctor's appointment scam as a means to generate excused absences, he will expect students to schedule medical appointments outside of class time. Exceptions will be made for emergencies and extenuating circumstances.

In this class, attendance is taken with an attendance sheet. Any forgeries of signatures (another scam) will result in the hour being counted as an unexcused absence for both the forger and the person for whom the forgery was attempted.

**Late Work**

It is the instructor’s policy to allow the class to negotiate due dates for out of class assignments. That being said, assignments **must be**
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turned in on time. There will be a penalty of -5% per day late. Any exceptions must be negotiated in advance.

Internet Resources
For easy access to these sites go to [http://www.northland.edu/oe](http://www.northland.edu/oe), click on “Course Descriptions,” scroll down to the Analysis of Human Performance heading, click on it to view an on-line syllabus, and click on the links listed below.

**Exercise Physiology: The Methods and Mechanisms Underlying Performance**
By: Stephen Seiler
[http://home.hia.no/~stephens/expphys.htm](http://home.hia.no/~stephens/expphys.htm)
This is a superb site combining excellent content and depth with clear explanations. This is a great adjunct source of information for this course.

**Muscle Physiology Resources**

*Muscle Structure and Physiology of Contraction*
[http://bama.ua.edu/~hsmithso/class/bsc_495/microfilaments/mf_web.html](http://bama.ua.edu/~hsmithso/class/bsc_495/microfilaments/mf_web.html)
[http://muscle.ucsd.edu/index.shtml](http://muscle.ucsd.edu/index.shtml) (Click on the home page photo to view text and images that support the photo).

Hitting your ‘refresh’ button on the home page will change/cycle the photos and topics

**The Introduction to Muscle Physiology and Design**

**Skeletal Muscle Architecture**

**Current Topics for Teaching Skeletal Muscle Physiology**

**Muscle Physiology Skeletal Fiber Distinctions**
[http://www.med.unibs.it/~marchesi/pps97/course/section12/actmyo_1.html](http://www.med.unibs.it/~marchesi/pps97/course/section12/actmyo_1.html)

**Anatomy Review: Skeletal Muscle Tissue**
[http://www.bmb.leeds.ac.uk/illingworth/oxphos/history.htm](http://www.bmb.leeds.ac.uk/illingworth/oxphos/history.htm) Mitochondria and Energy Metabolism

**Myosin/Actin**
[http://muscle.ucsd.edu/musintro/fibril.shtml](http://muscle.ucsd.edu/musintro/fibril.shtml)

**Muscle Ultrastructure.pdf**
[http://www.med.unibs.it/~marchesi/pps97/course/section11/assembli.html#actin_filaments](http://www.med.unibs.it/~marchesi/pps97/course/section11/assembli.html#actin_filaments)

**Cross Bridge Cycle**
[http://www.sci.sdsu.edu/movies/actin_myosin.html](http://www.sci.sdsu.edu/movies/actin_myosin.html) (Excellent [and fun] Actin Myosin Crossbridge 3D Animation from the folks @ San Diego State University. If you select the Quick Time player, you'll be able to view the process in stop action, or fast forward, to simulate ‘real time’)
[http://www.ebsa.org/npbsn41/maf_home.html](http://www.ebsa.org/npbsn41/maf_home.html) Dr. Michael Ferenczi's Home Page- Pi release during the cross bridge cycle and contractile animations

**Titin**
[http://www.embl-heidelberg.de/ExternalInfo/Titin/old_stuff/elasticity.html](http://www.embl-heidelberg.de/ExternalInfo/Titin/old_stuff/elasticity.html)
[http://www.ks.uiuc.edu/Research/titinIg/](http://www.ks.uiuc.edu/Research/titinIg/)
[http://moon.ouhsc.edu/dthompso/namics/actpass.htm](http://moon.ouhsc.edu/dthompso/namics/actpass.htm)

**Titin abstract.pdf**

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Introduction: Striated Muscle of Vertebrates
http://www.embl-heidelberg.de/ExternalInfo/Titin/titin-page1.html

Abstract: The Kinase Domain of Titin Controls Muscle Gene Expression and Protein Turnover
http://www.sciencemag.org/cgi/content/abstract/sci;1110463v1

Anchoring of the giant muscle protein titin in muscle cells
http://hasylab.desy.de/news_events/research_highlights/archive/anchoring_titin_in_muscle_cells/index_eng.html

Role of Titin in Vertebrate Striated Muscle

Abstract: Disuse-induced Preferential Loss of the Giant Protein Titin Depresses Muscle Performance via Abnormal Sarcomeric Organization
Prof. Julio Fernandez

Reverse engineering of the giant muscle protein titin

Immunoglobulin-like modules from titin I-band: extensible components of muscle elasticity

Regulation of Skeletal Stiffness and Elasticity by Titin Isoforms: A Test of the Segmental Extension Model of Resting Tension

Nebulin
http://www.bms.ed.ac.uk/research/others/smaciver/Encyclop/Abp-n/Nebulin.htm
http://www.biol.unl.edu/~droot/Index.html
http://moon.ouhsc.edu/kfung/JTY1/NeuroHelp/ZNN0IE08.htm
http://www.biophysj.org/cgi/content/abstract/74/1/349
http://www.biophysj.org/cgi/content/abstract/68/2/598
http://www.bms.ed.ac.uk/research/others/smaciver/Encyclop/Abp-n/Nebulin.htm
http://www.biol.unl.edu/~droot/Index.html
http://moon.ouhsc.edu/kfung/JTY1/NeuroHelp/ZNN0IE08.htm
http://www.biophysj.org/cgi/content/abstract/74/1/349
http://www.biophysj.org/cgi/content/abstract/68/2/598

Desmin
http://moon.ouhsc.edu/kfung/JTY1/NeuroHelp/ZNN0IE09.htm
http://moon.ouhsc.edu/kfung/JTY1/NeuroHelp/ZNN0IE08.htm
http://www.med.unibs.it/~marchesi/pps97/course/section12/actmyo_2.html

Tendon Structure
20VOGEL.pdf
biomechanics.pdf
topic11_collagen.pdf

Neurology Resources

General
Neuroscience On-Line http://neuroscience.uth.tmc.edu/index.htm
Carlson’s Movement http://nawrot.psych.ndsu.nodak.edu/courses/Psych465.S.02/Movement/movement.html
Skeletal Motor Control: Motor Control Hierarchy Jaggar Neurophysiology Lectures 9 and 10
http://thalamus.wustl.edu/course/
http://www.bioweb.uncc.edu/humanphys/motor.htm
http://musom.marshall.edu/ana/grosshom/Musclesensory.html
http://www.neuro.wustl.edu/neuromuscular/index.html

Nerve Transmission (Depolarization)
http://www.accd.edu/sac/biology/ratorres/torrescourses/printouts/PTR22.htm
http://www.lifesci.ucsb.edu/~mcdougal/neurobehavior/modules_homework/animation1.html
http://www.lifesci.ucsb.edu/~mcdougal/neurobehavior/modules_homework/mod2.html
http://www.psych.ualberta.ca/~ITL/ap/ap.swf
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Neuromuscular Junction
http://64.233.167.104/search?q=cache:MiqUAqOc5n0J:www.linkpublishing.com/FTP/Muscle_Contraction.pdf+sarcolemma+%2B+depolarization+%2B+animation&hl=en Look for a link at the top of the page to view a PDF version

Proprioception-General
Muscle Receptors, Spinal Reflexes & Muscles.pdf By: Tutis Vilis
Muscle Sensory Control pdf
Muscle Sensory Control html http://musom.marshall.edu/anatomy/grosshom/Musclesensory.html
http://alice.nc.juji.ac.il/~presentations/physiology/1
http://home.epix.net/~tcannon1/physioweek4.htm
http://csbn.concordia.ca/psyc358/Lectures/reflexes.htm
http://aids.jallym.ac.kr/d/kns/tutor/medical/unified/spinalcord/spinalcord.html
http://www.utsc.utoronto.ca/~milgram/nroc64/move1.ppt
http://physio1.utmem.edu/~thomason/L10.pdf

Muscle Spindles
Muscle Sensory Control pdf
Muscle Sensory Control html http://musom.marshall.edu/anatomy/grosshom/Musclesensory.html
http://www.kcl.ac.uk/teares/gktvc/vc/lt/mspindle/
http://respiratory-research.com/content/2/Suppl%201/P31
http://thalamus.wustl.edu/course/spinal.html
Robotic Muscle Spindles.pdf
http://confocal.med.unc.edu/wwwBioConfocal/MuscleSpindle.html
Muscle Receptors, Spinal Reflexes and Muscles.pdf
http://www.ohwi.org/Presentations/Neurophysiology%20(Reflexes)%20&%20Osteopathic%20Manipulative%20Theory%20.ppt
Model of Muscle Spindle Proprioception http://ami.usc.edu/projects/ami/projects/bion/musculoskeletal/model_muscle_spindle.html#
Muscle spindles, Golgi tendon organs, and the neural control of skeletal muscle

Golgi Tendon Organs
Muscle Sensory Control pdf
Muscle Sensory Control html http://musom.marshall.edu/anatomy/grosshom/Musclesensory.html
http://www.exrx.net/Questions/GTO.html
http://www.ac.wwu.edu/~chalmers/forcefeedback.html
Muscle Receptors, Spinal Reflexes and Muscles.pdf
http://jp.physoc.org/cgi/content/abstract/2001.012785v1
Interactions Between Motor Units and Golgi Tendon Organs in the Tibialis Posterior Muscle of the Cat by Marc D. Binder and Connie E. Osborn
Responses of Isolated Golgi Tendon Organs of the Cat to Muscle Contraction and Electrical Stimulation by Yasushi Fukami
Muscle spindles, Golgi tendon organs, and the neural control of skeletal muscle

Reflexes
http://nawrot.psych.ndsu.nodak.edu/Courses/Psych465.S.02/Movement/Reflex.html From: Carlson's Movement
Vision and Motor Control
Generalization in vision and motor control by: Tomaso Poggio1 & Emilio Bizzi
http://www.icn.ucl.ac.uk/Experimental-Techniques/Multisensory/Multisensory.htm
Developmental Stages (Reflexes)
http://www.coe.unt.edu/goggin/kine3500/350lec6a.htm
http://primal-page.com/mf3-4.htm
http://www.emedicine.com/ped/topic2640.htm
The Value of Neonatal Neurological Assessment in Predicting Neurodevelopmental Problems at Preschool Age By: Aulikki Lano
http://www.cde.ca.gov/spbranch/sed/APE/apdxC.pdf
Interval Training
Interval Training PowerPoint
Human Kinetics Article
Muscle Chemistry Site
Interval Training PowerPoint2

Rice University: SportsMed Web
http://www.rice.edu/~jenky/ Go to the "Medical Tent"

Peak Performance On-Line
http://www.pponline.co.uk/
Excellent compilation of articles on diverse performance topics

SEACSM (Southeast American College of Sports Medicine)
http://www.fau.edu/divdept/exsci/resources.htm
This is a resource super-site with links to every imaginable sports medicine resource.

Frank I. Katch
http://www-unix.oit.umass.edu/~katch/index.html
Frank Katch is one of your textbook authors. This is a new site but may have useful, supplemental information.

Kinesiology and Physical Education Links
http://books.valdosta.edu/read/kspe.html
Physical Education Links including Biomechanics sites

Eric Midkiff Exercise Science Links

Human Performance Links
http://www.humanperformance.org/map.htm

Triathlon Related Links
http://www.ens-lyon.fr/~desprez/FILES/TRIATH/links.html

Health Oasis: Mayo Clinic
http://www.mayoclinic.com/index.cfm

Wheeless' Textbook of Orthopaedics
http://www.ortho-u.net/med.htm

Functional Strength Traning
http://72.14.203.104/search?q=cache:xR0pU9CE0QIJ:www.acefitness.org/nyforum/images/FabioComana_NYForum.ppt +%22functional+training%22&hl=en&gl=us&ct=clnk&cd=8 (Once opened, click on the link to the PowerPoint presentation @ the top of the page)
http://www.acefitness.org/
http://www.pponline.co.uk/encyc/warm-up-activity.htm Peak Performance: Warm-up
Changing Ideas Regarding Benefits
http://www.bodyresults.com/s2warmup.asp Dynamic Warm-up for Outdoor pursuits