

Biomechanics of Movement Term Paper

Objective of Assignment

This project will give you a chance to deepen your knowledge in an area of biomechanics that interests you. We expect that you will remember what you learn from writing this paper long after the class is over. This assignment will get you into the literature where you can see for yourself the results of biomechanics research. This paper may also serve as a springboard for a future independent studies or research projects. The project will help hone your critical reading and writing skills, which are helpful in many endeavors. This will also give you some team project experience.

Overview of Assignment

Survey the literature on a specific topic in the field of movement biomechanics. Describe the current state-of-the-art and suggest areas that require further research. Then briefly describe how you would investigate a specific problem yourself.

Some general areas from which you can choose a topic include: sports biomechanics, measurement of muscle strength, development of muscle strength, motion and gait analysis, dynamic simulations of movement, biomechanics of surgical reconstructions, functional neuromuscular stimulation, joint biomechanics, electromyography, muscle biology and mechanics, muscle models, muscle injury, motion analysis equipment and techniques, animal locomotion, neural control of movement, robotics, computer-assisted surgery, medical imaging, biomedical computation and visualization, computer animation, digital creatures, evolution of gait, or other areas related to biomechanics of movement. From these general areas you should choose a specific topic to investigate. Some topics and paper titles are listed below.

Example Titles of Term Papers

Strength of muscles crossing the shoulder and elbow, Muscle strength and its development
Effects of bone deformities on muscle moment arms, Adaptation of muscle with immobilization,
Gait analysis for surgical planning: benefits and limitations
Surgical planning using medical imaging, Robot-assisted surgery knee surgery
Biomechanics of bicycling: the role of two-joint muscles
The influence of increased muscle stiffness on movement deformities in cerebral palsy
The influence of energy storing prosthetic feet on knee motion in below knee amputee walking
The influence of dynamic coupling on motor planning in the upper limb
The variation of muscle physiologic cross-sectional areas with aging
The role of muscles in providing joint stability, Muscle-tendon adaptation with immobilization
Animation of body motion: from biomechanics to entertainment
Robots that walk and hop, Force-feedback devices: what is needed to fool the CNS?
Optimization techniques for calculating muscle forces
Computer-assisted design of functional neuromuscular stimulation systems
Scaling in musculoskeletal structures, Quantification of spasticity
In vivo imaging of joint kinematics, Three-dimensional models of muscle
Effects of bone lengthening on muscle, molecular motors: the engines of life
Computer-assisted surgery, Wrist joint replacements: successes and failures

Format of the Paper

The paper (excluding reference and figures) ***should not exceed ten, double-spaced pages.*** The paper is short, and needs to be extremely well written. A first draft should be written well in advance of the due date so that you have a chance to refine the final product. The paper should be written in the following form.

TITLE PAGE

ABSTRACT (about 150 words)

This is the most important section of any report and should summarize the key points of your paper.

INTRODUCTION & BACKGROUND (~1-2 pages)

Briefly describe what you will be presenting and why it is important. Relate the anatomical, biological, clinical, or business framework of your topic.

PREVIOUS INVESTIGATIONS (~4-6 pages)

Present a review of previous research on this topic. Do not simply review a number of individual papers, but try to synthesize what has been done. This section should be in a form such that the current state-of-the-art is easily appreciated. State the shortcomings in our current knowledge, and in a final paragraph or two suggest several areas that require further research.

PROPOSED RESEARCH (~2-4 pages)

From areas suggested at the end of the previous section, state concisely and specifically a particular problem that you propose to address. In broad terms, describe how you might investigate this problem with experiments, computer simulations, or both. Point out the difficulties that you may expect to encounter in this research. State what you believe will be the significance of your proposed research. Provide a realistic timetable for the completion of the work.

REFERENCES

Your paper should be referenced using primarily journal articles. References and reference citations should conform to the style of the *Journal of Biomechanics*. The following sources may be useful

Index Medicus

Science Citation Index

Journal of Biomechanics

Journal of Biomechanical Eng

Journal of Orthopaedic Research

Journal of Bone and Joint Surgery

Journal of Physiology

Google Scholar

Developmental Medicine and Child Neurology

Clinical Orthopaedics and Related Research

Biological Cybernetics

Journal of Biomedical Material Research

IEEE Transactions on Biomedical Engineering

..... and many others

Project Outline and Meetings with Teaching Staff

It is our hope that you start working your project going early. The outline will help you get started. It will comprise 5% of your grade.

Format of Outline

The written outline should include the following three sections.

1. INTRODUCTION & BACKGROUND
Briefly describe your topic and why it is important.

2. PREVIOUS INVESTIGATIONS
List several sources that relate to your topic. For each paper try to state:
 - the goal(s) of the paper
 - how this paper relates to your topic
 - the major conclusions
 - the major shortcomings
 - the next step in this research

3. REFERENCES
List at least ten references that relate to your topic. This list should conform to the style of the *Journal of Biomechanics*.

This is just an outline, so it can be rough. We just want to make sure that you are on the right track and are finding references that relate to your topic.

Project Presentations

This assignment is intended to let other students know about your project and give you experience articulating your ideas to a group. The presentation will comprise 10% of your grade.

Format of Oral Presentation

Each student team will give a short, 10-minute oral presentation on their research topic. Your presentation should state the problem you are investigating and what you have found. The intention is to let the class know about your topic and enlighten us with your findings. We will give an example presentation before yours are due. Feel free to be creative.