



# NORTHERN ARIZONA UNIVERSITY

**\*\* PLEASE NOTE: ADDITIONAL INFORMATION MAY BE REQUESTED AFTER REVIEW/UPDATES TO CURRICULAR FORMS\*\***

**CEFNS Curriculum Committee Proposal  
New Course  
Fall 2018**

1. Academic Unit: Biological Sciences

2. Course subject and number: BIO 412C  
*See upper and lower division undergraduate course definitions.*

Units: 3

3. Course Title: The Mechanics & Energetics of Locomotion  
*(max 100 characters including spaces)*

**Commented [NCH1]:** This was the original title, but it was too long for the course catalog.

4. Catalog course description *(max.200 words, excluding requisites):*

**This course will provide a culminating experience in the exercise science program. It consolidates the knowledge and understanding of anatomy, physiology, metabolism and kinesiology students have gained throughout their program to explore the mechanics and energetics of locomotion. Students then apply their synthesized understanding to examine exercise and clinical examples that they will encounter within their advanced therapeutic studies (physical therapy, occupational therapy, etc.).**

### **Section I**

**Attach the proposed syllabus (approved university format). Use the [Syllabus Guidelines](#) to ensure you have addressed syllabus aspects that will be reviewed by the College Curriculum and Assessment Committees.**

5. Justification for new course ([click for examples](#)):

*If the description of the role or importance of the course to the university's educational programs is the same as the Course Purpose (on the attached syllabus), then use it for the justification.*

Describe the role or importance of the course to the university's educational programs such as

- A requirement, elective, or recommended course within the academic unit of origin,
- A requirement, elective, or recommended course within other academic programs, and/or
- Addressing a university-wide curricular goal (the Global Learning Initiative, a general elective, university learning outcomes, co-curricular learning outcomes).

For Undergraduate Courses:

- A Liberal Studies course (college's representative(s) to the Liberal Studies Committee will review the proposal using LS criteria prior to the review by the College Curriculum & Assessment Committee), and/or
- A Diversity course (Diversity Sub-committee representative(s) will review the proposal using Diversity requirement criteria prior to the review by the College Curriculum & Assessment Committee).

**This course will play several roles. First, the course will be an option for the required capstone courses in the Exercise Science major. Second, this will fill a need in the Exercise Science curriculum as there are currently not enough seats in capstone courses to accommodate the number of students that need the course to graduate (i.e., to keep enrollment in the 30 student range pre course). Third, this course will be an option as an elective for students in Biomedical Science and/or Biology. Finally, this course will provide breadth to the Biological Sciences course catalog so that undergraduate and graduate students have more options to gain knowledge in a potential area of specialization.**

6. Describe how the course is related to short- and long-term plans of the academic unit. Ensure your description addresses at least one of the following:

- Improvements to the program (aligning curriculum to new or current curriculum standards or expectations, improving degree program progression, integration of learning from one course to another),
- Requirements or recommendations set forth by the program's periodic review, or in preparation for its next review (addressing improvements based on input from external reviewers, industry trends, new or changing governmental regulations or external accreditation requirements),
- Academic unit goals identified in a unit's Annual Report on Curriculum & Assessment,
- Evidence and assessment findings (assessments of student learning, needs assessments, student or employer surveys, comparisons to other programs in the field),
- Other important aspects of the academic unit and student learning not identified above.

**This course addresses short term needs for the Exercise Science major because it provides an additional capstone option for students. We currently have an insufficient number of seats in capstone courses to accommodate the number of students needing to enroll (to keep class size around 30 students per course). It also addresses a longer term need as many exercise students wish to go into areas such as physical therapy, yet the program does not currently offer a capstone specialization in a related area.**

7. Is this course in any plan (major, minor, or certificate) or sub plan (emphasis)? Yes  No   
If yes, list and include the appropriate plan proposal.

**Exercise Science; B.S.**

8. Is this course in any CAEP Accredited plan? Yes  No   
If yes, list and include the appropriate plan proposal.

9. Proposed [Co-convene](#) with: \_\_\_\_\_

10. Proposed [Cross-list](#) with: \_\_\_\_\_

11. Proposed Prerequisites: BIO 334, BIO 338, BIO 338L  
If prerequisites, list each pre-requisite and provide a clear description of how each pre-requisite supports the learning in the course.

**BIO 334 – Functional anatomy and kinesiology provides a basic foundation of knowledge in the areas of anatomy, movement description and the application of mathematical knowledge to movement.**

**BIO 338 and 338L – Physiology of exercise lecture and labs provides an understanding of the physiological principles of and techniques used in exercise physiology, so preparing the students for the energetics aspect of the course.**

12. Proposed Co requisites: \_\_\_\_\_  
If co requisites, list each co-requisite and provide a clear description of how each co-requisite supports the learning in the course.

**Questions 13-14 for Undergraduate Courses only:**

13. Is this course being proposed for Liberal Studies designation? Yes  No

If yes, which designation:

[Aesthetic and Humanistic Inquiry](#)  [Cultural Understanding](#)  [Science](#)   
[Social and Political Worlds](#)  [Senior Capstone](#)  [Junior Level Writing Course](#)

If yes, which Essential Skill:

(For Senior Capstone courses, please select 2 skills; For Junior Level Writing Courses, please select "Effective Writing"):

[Critical Thinking](#)  [Effective Writing](#)  [Oral Communication](#)   
[Scientific Inquiry](#)  [Quantitative Reasoning](#)  [Creative or Aesthetic Thinking](#)

CONTACT: Natalie Holt, [Natalie.Holt@nau.edu](mailto:Natalie.Holt@nau.edu), 3-3865

14. Is this course being proposed for Diversity designation? Yes  No

If yes, which designation:

[US Ethnic Diversity](#)  [Global Diversity](#)

**Section II**

15. Resource Implications

15a. Will the new course result in:

- an increase in library holdings and electronic or research resources for this course? Yes  No

If yes, list:

- the need for equipment or technology, particularly in the classroom? Yes  No

If yes, list:

- changes in the classroom space needed for the course? Yes  No

If yes, list:

- impacts on scheduling this course or other course offerings of the academic unit? Yes  No

If yes, list:

15b. Projected frequency of offering the new course

- Identify how many sections of this course would be offered each semester or academic year over the next five academic years.

**One section every Spring semester (1 offering per academic year)**

- Based on the frequency the academic unit would offer this course, what is the expected impact on enrollments and offerings of other courses within the academic unit?

**Based on the number of new and established students in Exercise Science and Biomedical Sciences it is expected that this course will fill up each offering.**

- Based on enrollment and course offering projection, will additional resources be needed to offer the course? Yes  No

If so, what resources are requested to offer this course?

- If additional resources are not received, how will the unit change its course offerings, course capacities, and/or teaching loads in order to accommodate the inclusion of this course into the curriculum?

16. Impacts to Other Academic Units or Programs

16a. Projected impacts to enrollments and courses in other academic units or programs: Based on the frequency of offering this course, what is the expected impact on enrollments and offerings within other academic units or programs?

**This course will not have a negative impact on academic units outside of Biological Sciences. The impact on units within Biological Sciences will only be positive as it will provide an additional capstone option for students which will bring enrollment in other capstone courses down to the 30 students per course range.**

16b. If other academic units or programs are impacted by this proposal, what discussions and actions have been taken for notification and/or resolution?

**N/A**

17. Duplication or Perceived Duplication of Course:

17a. Does this course appear to duplicate other courses offered at Northern Arizona University?

Yes  No

If so, which courses?

Upon reviewing course materials of other courses which may duplicate the course:

17b. Are each of the course purpose statements specific enough to differentiate the courses from each other? Yes  Needs Improvement  No

If not, or if it needs improvement, what elements need to be specified to differentiate the course from other courses?

17c. Are the intended course student learning outcomes specific enough to differentiate the courses from each other? Yes  Needs Improvement  No

If not, or if it needs improvement, what elements need to be specified to differentiate the course from other courses?

### Section III

18. May course be repeated for additional units? Yes  No

18a. If yes, maximum units allowed? \_\_\_\_\_

18b. If yes, may course be repeated for additional units in the same term? Yes  No

19. Grading option: Letter grade  Pass/Fail  Both

20. Does this course include combined lecture and lab components? Yes  No

If yes, include the units specific to each component in the course description above.

21. Does this course include an [experiential learning](#) component? Yes  No

22. Class Instruction Mode: In-person  Online  Blended   
If In-person or Blended, where will the course be offered? FLGMTN  Other

23. Which terms will the course be offered?  
Fall  Winter  Spring  Summer   
Other  \_\_\_\_\_ (Fall/Even Yrs, Spring/Odd Yrs, Intermittent, etc.)

24. Do you anticipate this course will be scheduled outside the regular term? Yes  No

If yes, please refer to: <http://nau.edu/Registrar/Faculty-Resources/Schedule-of-Classes-Maintenance/>

25. Will there be a new request for a course fee? Yes  No

If yes, please refer to: <http://nau.edu/Registrar/Faculty-Resources/Course-Fees/>

**Scott Galland**

Reviewed by Curriculum Process Associate

**2/22/2017**

Date

**Approvals:**

	2/24/17
Department Chair/Unit Head (if appropriate)	Date
Dean of College	Date

**PROPOSED SYLLABUS:**

Capstone Syllabus Template

**College** Biology

**Department/ Academic Unit** Bio

**Course prefix, Section number and Title:** BIO 412C (capstone) Mechanics and energetics of locomotion

**Term/ Year** Fall 2018

**Total Units of Course Credit** 3

**Course Pre-requisite(s):** BIO 334, BIO 338, BIO 338L

**Mode of Instruction:** Seminar

**Instructor's Name** Natalie Holt

**Instructor's Contact Information** Natalie.Holt@nau.edu

Office – Biological sciences 426

**Instructor's Availability** Office hours - 12noon-1pm Monday and Wednesday

**Course Purpose**

This purpose of this course is to provide a culminating experience for exercise science majors. It addresses the *Science and Applied Science distribution block* by consolidating the knowledge and understanding of anatomy (BIO201/ BIO202), physiology (BIO201/ BIO202), metabolism (BIO338) and kinesiology (BIO334) students have gained throughout their program. Students will apply this knowledge to develop a framework for understanding the mechanics and energetics of locomotion. Students will be prepared for a variety of graduate-level options (such as physical therapy, occupational therapy, and research programs) by :

- learning how to use existing knowledge to evaluate primary literature in an area that is novel to the student;
- applying knowledge of movement to clinical settings in order to develop evidence based training and rehabilitation programs.

Students will engage in the skills of *critical thinking* and *scientific enquiry* by using their existing knowledge to evaluate scientific papers. In addition, they will apply exercise science techniques and methods learnt throughout their program to devise a mock research paper in which they formulate a hypothesis and propose a means by which to test it. *Quantitative reasoning* skills will be developed by combining biological and mathematical skills to quantitatively understand locomotor mechanics and energetics. Students will develop *written* and *oral communication skills* by writing a mock research paper and presenting this to the group. These skills will be developed by formal instruction, regularly presenting the findings of primary literature in class and by getting feedback on early drafts of their work.

**Course Learning Outcomes**

Effective Fall 2016

By the end of this course, students will be able to:

1. Describe how the neuromuscular system produces movement, so demonstrating their knowledge of the natural world and ability to apply basic anatomy and physiology to a new paradigm (Science & Applied Science Distribution Block).
2. Explain the mechanical principles of locomotion and link them to the metabolic costs incurred, so integrating their understanding of kinesiology and metabolism to synthesize a basic framework for understanding movement (Science & Applied Science Distribution Block).
3. Use basic models and simple mathematics to describe locomotion and evaluate current theories of movement so demonstrating their ability to use quantitative reasoning and critical thinking.
4. Apply these biological and mathematical concepts to understanding movement in a range of environmental and clinical situations and evaluating technological aids to movement, so demonstrating an awareness of the potential professional application of an understanding of the mechanics and energetic of locomotion (Science & Applied Science Distribution Block).
5. Evaluate and use primary literature as a source of basic information so demonstrating critical thinking and an understanding of how the scientific method advances knowledge.
6. Show an understanding of the scientific method and the process of scientific inquiry.
7. Demonstrate effective oral and written presentation skills.

#### **Assignments/ Assessments of Course Student Learning Outcomes**

Assignment - Mock research paper (total 50%)

In this assessment, students will choose a basic or applied question of interest to them in the broad area of locomotor mechanics and energetics. They will then explore the peer reviewed and primary literature on the topic, formulate a testable hypothesis and devise a suitable experiment.

*Research paper proposal presentation* – students will give a 10 min oral presentation outlining their rationale, hypothesis and experimental design (this is a chance to get feedback on ideas before the written submission) (20%)

*Research paper* – students will write a mock research paper in the style of a J. Exp. Biol. paper (~ 4 pages in length) outlining their rationale, stating their hypothesis, describing their experimental approach, predicting expected results and discussing their expected findings in a broader context (30%)

This assessment allows students to demonstrate:

- knowledge of the subject area and critical thinking skills in assessing current literature and integrating this to formulate an appropriate question (learning outcomes 1 and 5)
- understanding of the scientific method and process of scientific inquiry in formulating a testable hypothesis and designing an appropriate experiment (learning outcome 6)
- ability to evaluate the capacity and limitations of techniques in answering specific questions (learning outcome 4)
- ability to integrate your “findings” into existing literature so synthesizing an updated understanding the mechanics and energetics of locomotion (learning outcome 2)
- understanding of the purpose and structure of primary literature (learning outcome 5)
- effective oral and written communication skills (learning outcome 7)

Mid-term exam – Take home short answer questions and a choice of essay questions (20%)

Final exam – Take home short answer questions and a choice of essay questions (30%)

In these exams, students will demonstrate their knowledge and understanding of anatomy, physiology, metabolism and kinesiology and show that they are able to integrate this to understand locomotion. These exams provide students with an opportunity to show that they have integrated knowledge across a broad subject area (as opposed to the more focused, single topic assignment) and the open book nature encourages a focus on developing deeper concepts and linking topics rather than memorizing facts. In addition, exams are an essential part of the graduate school process, hence taking a variety of styles of exams will help to prepare students for the exams they will be required to take throughout their graduate career.

These assessments allow students to demonstrate:

- quantitative reasoning skills in applying mathematical concepts to biological problem (learning outcome 3)
- ability to synthesize and critically evaluate information from diverse fields and primary literature and apply it to the mechanics and energetics of locomotion (learning outcomes 2 and 5)
- understanding of the application of a framework for understanding locomotor mechanics and energetics to a variety of clinical and environmental situations and technological advances (learning outcomes 1, 2 and 4)

#### Grading System:

Mock research paper (total 50%)

- research paper proposal presentation (20%)
- research paper (30%)

Midterm exam (20%)

Final exam (30%)

Grades will be based on

A = 90.0-100%

B = 80.0-89.9%

C = 70.0-79.9%

D = 60.0-69.9%

F = 0-59.9%

#### Readings and Materials

Recommended texts:

- 'The neuromechanics of human movement' by Roger Enoka 5<sup>th</sup> Edition
- 'Principles of animal locomotion' by R. McNeil Alexander
- 'Animal locomotion' by Andrew Biewener
- PDFs of primary literature will be provided each week

#### Class Outline or Tentative Schedule

Each week will start with a lecture based class in order to review and cover the essential material. The second class of the week will then focus on the student led discussion of primary research papers.

Week	Topic	Deadlines
1	Intro	
2	Muscle	
3	Elastic mechanisms	
4	Mechanical energy of movement	
5	Metabolic energy consumption	
6	Gaits	
7	Models of walking and running	
8	Midterms	
9	Spring break	
10	Oral and written communication skills	
11	Research paper proposal presentations	Paper proposals due
12	Stability	
13	Surfaces and routes	
14	Ontogeny and ageing of locomotion	Research paper due
15	Aids to movement	
16	Finals	

#### Class Policies:

##### Attendance

Effective Fall 2016

You are expected to attend all classes and complete the required work to meet each deadline. You are responsible for all information, announcements, handouts, and materials given in class. You are expected to be on time for class.

#### Late work

One full grade will be deducted for each day the work is late. Work turned in more than 3 days late will receive a grade of zero.

#### Challenging exam questions

Should you feel a question was unfair or unclear, you may challenge the question up to one week after exam scores are released. However, in order to do so you must:

1. Make an appointment to discuss and demonstrate why the question was unfair or unclear. This will be done on an individual basis; no group appointments will be allowed.
2. You must **effectively** and **professionally** argue your point.
3. Email explanations will not be accepted.

I will assign credit to those that can **effectively** and **professionally** argue their point.

#### Make-up exams

Make-up exams will only be given if arranged ahead of time (e.g., Institutional accepted absence) and/or with the proper documentation in the case of an emergency (e.g., note from your physician or Student Life). I do not necessarily need to know the details of your absence, so if you are not comfortable discussing this please acquire documentation from Student Life. If arrangements have not been made and you have failed to contact me **within 48 hrs** of missing the exam you will receive a grade of zero on the exam.

#### Academic dishonesty

##### General Responsibilities

1. A student shall in no way misrepresent his or her work.
2. A student shall in no way attempt to achieve a grade through fraudulent or unfair means.
3. A student shall not in any other manner violate the principle of academic integrity.
4. A student shall report any observed violations of the academic integrity policy.

##### Examples of Violations

The following actions are examples of activities that violate the Academic Integrity Policy. This is not a comprehensive list.

Cheating is the intentional use of, or attempted use of, unauthorized materials, information, study aids, or previously prepared solutions in any academic exercise, exam, paper or other assignment. Cheating includes, but is not limited to the following acts:

- Copying another student's work.
- Sharing answers for either a take-home or in-class examination unless specifically and explicitly allowed.
- Using notes, books or web materials in an exam when such aids are forbidden.
- Taking an examination in another student's name or having another person take one for a student.
- Changing the answers in an examination after it has been graded in order to gain more credit than deserved.
- Possession of a "cheat-sheet" or other prohibited assistance (calculator, cell phone, text messaging, etc.) during an examination.
- Working on an examination outside the specified time limits, such as beginning before the faculty member directs students to begin, or continuing to work after the faculty member has declared an end to the examination period.
- Using a commercial service or engaging another person (whether paid or unpaid) to prepare assigned work. Unless prohibited by the faculty member for educational reasons, editing and/or proof-reading by another person is not considered cheating.

Northern Arizona University regards acts of academic dishonesty—including, but not limited to, plagiarism, cheating, fabrication, forging an instructor's signature, stealing tests, copying themes or tests from other students, or using "cheat sheets"—as very serious offenses.

If you are charged with academic dishonesty, you are subject to the Arizona Board of Regents' Student Code of Conduct and procedures established by Northern Arizona University, specifically the Academic Dishonesty policy, that are outlined in the [Online Student Handbook \(http://home.nau.edu/studentlife/handbook.asp\)](http://home.nau.edu/studentlife/handbook.asp).

Depending on the infraction, the following actions may be taken, but are not limited to:

- Educational assignments such as completion of an academic dishonesty tutorial or a learning module
- Reducing the grade on the assignment or examination
- Awarding a grade of zero or "F" on the assignment or examination
- Reducing the final grade in the course by one letter grade
- Awarding a failing grade in the course
- Warning the student in writing about the incident

The Instructor of the course will determine which course of action is most appropriate for the infraction.

*NORTHERN ARIZONA UNIVERSITY*

**POLICY STATEMENTS FOR COURSE SYLLABI**

[HTTP://NAU.EDU/CURRICULUM-AND-ASSESSMENT/ FORMS/CURRICULAR-POLICY/SYLLABUS POLICY STATEMENTS/](http://nau.edu/curriculum-and-assessment/forms/curricular-policy/syllabus-policy-statements/)