Morphometrics (ANG6930)
Syllabus – Fall 2021

Lectures: **Tuesday 10:40am-12:35pm (4-5 period) – UST0105**
Thursday 10:40am-11:30pm (4 period) – UST0105

Instructor: **Dr. Valerie Burke DeLeon**
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Office hours: Turlington B374; Wednesday 10:00am-12:00pm and by appointment

Course Description:

This is an applied workshop course in *Morphometrics*, the statistical analysis of shape. Thursday classes will include a lecture on theory, and Tuesday classes will usually include a discussion period, a demonstration of methods used, and "workshop" time for independent progress on class assignments. Readings will be assigned from the text or posted to the website for each week. Grades are based on timely submission of weekly assignments and the submission and presentation of a final project.

Course Objectives:

1) Learn to think critically about the quantification and analysis of shape.
2) Gain practical experience in collecting precise and repeatable landmark coordinate data.
3) Become familiar with commonly used morphometric software packages and their appropriate use.

Course Materials:

Text:
Zelditch M, *Geometric Morphometrics for Biologists*

Software programs (all freeware):
Fiji
3D Slicer
R and RStudio
MorphoJ
WinEDMA
PAST

Website:
Canvas (ufl.instructure.com)

Communication: Email is the best way to reach Dr. DeLeon (vdeleon@ufl.edu). Please use "Morphometrics" in the subject line.

Final Project: You will use methods discussed in this course to design and implement a research project that includes the statistical analysis of *shape*. You may have overlap between this project and other program requirements (e.g., course projects). The final project should be written in manuscript form and include the following estimates of *text* length. In addition, please include figures, which may be embedded in or follow the text.

Title page
Introduction (statement of hypothesis with relevant, ***brief*** literature review) ~ 2 page
Materials and Methods (emphasis is on this section; be explicit) ~ 2 pages
Results (include references to tables, figures, and statements of statistical significance) ~ 2 pages
Conclusions (inferences based on the results and possible future directions) ~ 1 page
References
Tables and Figures are **in addition** to these text guidelines

Each student will also prepare and present a 15-minute Powerpoint presentation to the class. Equal time should be allocated to describing 1) data collection and analytic methods, 2) results and interpretation, and 3) advice, tips, and suggestions for your classmates. Presentations are intended to be fun and informative, so please talk to Dr. DeLeon in advance if you have any concerns about this requirement.

Grading: Homework assignments (approximately 12) are equally weighted and count for 60% of your grade. To encourage participation in discussion of articles, 15% of your grade will be based on submission of potential research articles and discussion questions for assigned articles. The final project (written and/or oral presentation portion) counts for 25% of your grade. Letter grades are assigned in accordance with university policy.

Attendance: Our learning environment depends heavily on discussion, and each student has a responsibility to attend and contribute to the class. If you are ill or withheld from campus, please stay home. It is your responsibility to communicate with Dr. DeLeon about making up missed work in a timely manner.

Course Evaluations: You are encouraged to share your opinions at any time with Dr. DeLeon in person or by email. In addition, students are expected to provide feedback on the quality of instruction in this course by completing online evaluations at https://evaluations.ufl.edu. Summary results of these assessments are available to students at https://evaluations.ufl.edu/results/. The format of this course is modified every year in response to student feedback.

University Policy on Accommodating Students with Disabilities: Students requesting accommodation for disabilities must first register with the Dean of Students Office (http://www.dso.ufl.edu/drc/). The Dean of Students Office will provide documentation to the student who must then provide this documentation to the instructor when requesting accommodation. You must submit this documentation prior to submitting assignments or taking the quizzes or exams. Accommodations are not retroactive,

therefore, students should contact the office as soon as possible in the term for which they are seeking accommodations.

University Policy on Academic Misconduct: Academic honesty and integrity are fundamental values of the University community. Students should be sure that they understand the UF Student Honor Code at http://www.dso.ufl.edu/students.php.

COVID Statement: In response to COVID-19, the following practices are in place to maintain your learning environment, to enhance the safety of our in-classroom interactions, and to further the health and safety of ourselves, our neighbors, and our loved ones.

- If you are not vaccinated, get vaccinated. Vaccines are readily available at no cost and have been demonstrated to be safe and effective against the COVID-19 virus. Visit this link for details on where to get your shot, including options that do not require an appointment: https://coronavirus.ufhealth.org/vaccinations/vaccine-availability/. Students who receive the first dose of the vaccine somewhere off-campus and/or outside of Gainesville can still receive their second dose on campus.

- You are expected to wear approved face coverings at all times during class and within buildings even if you are vaccinated. Please continue to follow healthy habits, including best practices like frequent hand washing. Following these practices is our responsibility as Gators.
    - Sanitizing supplies are available in the classroom if you wish to wipe down your desks prior to sitting down and at the end of the class.
    - Hand sanitizing stations will be located in every classroom.
- If you are sick, stay home and self-quarantine. Please visit the UF Health Screen, Test & Protect website about next steps, retake the questionnaire and schedule your test for no sooner than 24 hours after your symptoms began. Please call your primary care provider if you are ill and need immediate care or the UF Student Health Care Center at 352-392-1161 (or email covid@shcc.ufl.edu) to be evaluated for testing and to receive further instructions about returning to campus. UF Health Screen, Test & Protect offers guidance when you are sick, have been exposed to someone who has tested positive or have tested positive yourself. Visit the UF Health Screen, Test & Protect website for more information.
    - Course materials will be provided to you with an excused absence, and you will be given a reasonable amount of time to make up work.
    - If you are withheld from campus by the Department of Health through Screen, Test & Protect you are not permitted to use any on campus facilities. Students attempting to attend campus activities when withheld from campus will be referred to the Dean of Students Office.
- Continue to regularly visit coronavirus.UFHealth.org and coronavirus.ufl.edu for up-to-date information about COVID-19 and vaccination.

Course Schedule:

Aug	24	LECTURE: **Morphometrics Overview** READING: none WORKSHOP: Review software programs ASSIGNMENT: Install software for use on your personal computer (due 9/2)
	26	LECTURE: **Shape** READING: Zelditch, Ch 1 and 2 ASSIGNMENT: Describe a research problem wrt shape (due 9/2)
	31	READING: TBD WORKSHOP: Troubleshoot software programs; Working with data in R ASSIGNMENT: Working with data in R (due 9/9)
Sep	2	LECTURE: **Landmark Coordinate Data** READING: Zelditch, Ch 1 and 2 ASSIGNMENT: Choose landmarks and provide explicit definitions (due 9/9)
	7	DISCUSSION: Landmark definitions WORKSHOP (Fiji): Use Fiji to collect metric data from 2D images
	9	LECTURE: **Geometric Morphometrics: Superimposition methods** READING: Zelditch, Ch3 ASSIGNMENT: Superimposition worksheet (due 9/16)
	14	READING: *Article TBD (Procrustes superimposition)* WORKSHOP (3D Slicer): Use 3D Slicer to collect metric data from 3D volumes
	16	LECTURE: **Geometric Morphometrics: Shape Space and ProcD analysis** READING: Zelditch, Ch4, skim Ch5 ASSIGNMENT: Format data for import to R. Use R Geomorph to calculate shape coordinates and compare samples (due 9/23).
	21	READING: *Article TBD (Group comparisons)* WORKSHOP (R geomorph): Use R Geomorph to calculate shape coordinates and compare samples. Address data formatting issues.
	23	LECTURE: **Principal Components Analysis** READING: Zelditch, begin Ch 6; skim Ch 8 and 9 ASSIGNMENT: Use R to produce a figure and detailed caption illustrating some interesting aspects of the combined dataset in a PCA plot (due 9/30).
	28	READING: *Article TBD (PCA)* WORKSHOP (Graphics in R): Use R to visualize and explore data
	30	LECTURE: **Size, Allometry, and Form Space** READING: *Article TBD* ASSIGNMENT: Produce another figure illustrating how "size" may or may not be related to observed shapes (due 10/7).
Oct	5	READING: *Article TBD (Allometry)* WORKSHOP (MorphoJ): Use MorphoJ to explore data, including options for superimposition, identifying errors and outliers.
	7	LECTURE: **Outlines, Surfaces, and Semilandmarks** READING: Zelditch, Ch ASSIGNMENT: Use R Geomorph to compare shape across samples (data provided) (due 10/14).
	12	READING: *Article TBD (Semilandmarks)* WORKSHOP: Resampling curves (and surfaces); evaluate existing software

	14	LECTURE: **Measurement Error** READING: von Cramon-Taubadel et al., 2007 ASSIGNMENT: Critically assess your own original data collection vs the mean estimates for the class (due 10/21).
	19	READING: *Article TBD (Measurement error)* WORKSHOP: Using R to quantify and illustrate measurement error
	21	LECTURE: **Asymmetry and Missing Data** ASSIGNMENT: Prepare a one paragraph summary outlining question, samples, data, and analyses for final project (due 10/28). Assignment TBD (due 10/28).
	26	READING: *Article TBD (Asymmetry)* WORKSHOP: Present and discuss plans for final projects
	28	LECTURE: **Phylogenetic Effects** READING: TBD ASSIGNMENT: Assignment TBD (due 11/4).
Nov	2	READING: *Article TBD (Phylogenetic effects)* WORKSHOP: Using R to test effects of phylogeny on shape
	4	LECTURE: **Modularity and Integration** READING: TBD ASSIGNMENT: Assignment TBD (due 11/11).
	9	READING: *Article TBD (Modularity or integration)* WORKSHOP: Using MorphoJ to assess modularity; Using Geomorph to assess integration
	11	LECTURE: **Canonical Variates and Discriminant Function Analyses** READING: Zelditch, finish Ch 6 ASSIGNMENT: Compare and contrast PCA and canonical variates analysis from combined data (due 11/18).
	16	READING: *Article TBD (CVA or DFA)* WORKSHOP: Use R Geomorph to run canonical variates and discriminant functions, test significance, and interpret results.
	18	LECTURE: **Euclidean Distance Matrix Analysis** READING: Richtsmeier et al., 2002 ASSIGNMENT: Use the combined dataset to conduct an analysis in WinEDMA, and illustrate and interpret the results (due 11/24).
	23	READING: *Article TBD (EDMA)* WORKSHOP: Format combined data for import to WinEDMA. Use WinEDMA for data visualization and analysis.
	25	**THANKSGIVING – NO CLASS**
	30	Presentation of Final Projects (5)
Dec	2	Presentation of Final Projects (2)
	7	Presentation of Final Projects (4)
	13	Final papers DUE

***** Assignments are subject to change, but ample notice will be provided in advance!**