Mammalogy

SNC 320 and CCS 320 (Online Course)

Contents

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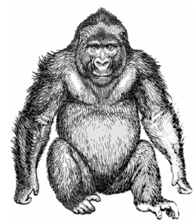

COURSE SYLLABUS

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Course Description:

This course will introduce you to the origins, evolution, ecology, and biodiversity of the class Mammalia. Key topics will include mammalian anatomy, classification, genetics, reproduction, thermoregulation, locomotion, behavior, ecology, and conservation. Special emphasis will be on investigating the connections of mammalian evolutionary biology to human health issues including disease, nutrition, physical activity, injury, and overpopulation. Online learning will incorporate readings, discussions, a science 'kit' for hands-on labs, virtual labs using 3D mammals, and computer simulations. Student will also undertake collaborative experimentation and onsite inquiry of mammals at a zoological park, museum, and/or nature reserve. Prerequisite: None.

Learning Experience

This course is **online asynchronous** and progresses through 10 Mammalogy -themed modules that employ readings (text and scholarly articles) and multimedia resources (online videos and multimedia). Students are not required to meet at a specified time as a class, however the instructor provides optional synchronous consultations particularly in support of lab activities. The instructor provides weekly and other intermittent news communications to the class around upcoming assignments and learning activities. The instructor provides students with weekly assessments of their ongoing work and this communication serves as a high frequency engagement between instructor and student. Student assessment includes guidance on the resubmission of assignments for more points and to increase competence in the subject matter. Additional course guidance is provided by the instructor through individualized zoom sessions upon request.

Students are required to participate and engage with classmates in weekly online discussion boards that explore and reinforce module concepts and critical thinking through original contributions and collaborative responses. For the collaborative group lab, peers communicate with their lab partners synchronously through zoom or other platforms. The culminating group lab project centers on a formulated Mammalogy hypothesis at a zoological park, natural history museum, or nature reserve. This project includes a presentation to the class as a whole including feedback from peers. Labs are submitted using a conventional lab form. Students also complete a short original inquiry research paper following a scientific format.

The course uses short video lecture clips to introduce key module concepts and lab procedures. Laboratory exercises employ virtual mammal specimens, animal dissection simulations, 3D human and other mammal skeletal models, zoological park mammals and/or museum specimens, and online Mammalogy databases. Certain labs are collaborative requiring students to collect data and contribute to the broader analysis of the experimental results. Laboratory experiments alternate with virtual fieldtrips every other Module.

Course Learning Outcomes:

General Learning Outcomes:

Upon successful completion of this course, all students are expected to have demonstrated the following abilities:

- Can analyze and apply information generated from scientific investigations in Mammalogy.
- Can describe, differentiate, and explain form, function, and variation within mammal lineages.
- Can evaluate the role of mammal evolutionary history on human health.
- Can compare and contrast aspects of mammal behavior and ecology.

Liberal Studies Program - Course Learning Outcomes for Scientific Inquiry (Lab)

Category	***Learning Outcome***
Scientific Inquiry-Laboratory (SI-Lab) courses	Students will be able to:
Students will understand how science serves as a mechanism for inquiry into the natural world through hands-on, experience-based investigation.	A. Pose meaningful scientific questions and generate testable scientific hypotheses.
	B. Plan, design, and conduct scientific investigations in a collaborative environment using appropriate tools and techniques to gather relevant data in order to test and revise scientific hypotheses.
	C. Develop and use scientific models (conceptual, physical, and mathematical) to make predictions and develop explanations of natural phenomena.
	D. Address variability in the data and recognize and analyze alternative explanations and predictions.

	E. Communicate scientific procedures, results, and explanations and engage in arguments based on scientific evidence.

How this course nurtures the Scientific Inquiry (Lab) outcomes:

Learning Outcome	***Demonstration***
Scientific Inquiry-Laboratory (SI-Lab) courses **Students will understand how science serves as a mechanism for inquiry into the natural world through hands-on, experience-based investigation.**	a. Students will have multiple entry points to posing scientific questions and testing scientific hypotheses connected to mammal natural history. For the research paper assignment, students will identify a plausible research question/hypothesis through examination of current scholarly literature. They obtain and analyze their data on the self-selected mammal issue via the literature. In virtual fieldtrips (VF) students will pose original hypotheses about human embryology, niche partitioning, and crossbreeding. Finally, in the 6 Labs conducted in the course, students will form and test hypotheses as an individual (L2-6), a group (L6), and with the entire class (L1).
	b. Mammalogy incorporates 6 lab exercises on the key topics of identification, anatomy, brain and skull development, bipedality, and ecology. For each of the labs students determine and apply an appropriate methodology to address questions, collect data, and analyze results with regard to falsification or support of a hypothesis and to indicate their study's caveats and conclusions. Where students are in a group, the team first discusses the lab objective(s) and the best approach using the general techniques and tools/specimens/databases provided. Examples of potential hypotheses examined in labs include whether modern small mammal anatomy parallels early fossil mammal anatomy, whether human brain development has made us more inclined for Alzheimer's disease, whether bipedality is responsible for human spine, hip and leg issues, whether mammal distributions in Gorongosa National Park can be predicted based on seasonal food change and so on.
	c. The science of mammalogy uses a number of scientific models including those related to the evolution of the group (e.g., ear development, molarization, encephalization, thermoregulation, reproduction, bipedality) as well as biomechanical models for mammal locomotion and others to explain disease such as Alzheimer's. Students will use these models to build understanding of mammal natural history and its connection to human health. In addition, they will employ measurements and basic statistical procedures using excel in select labs (basic linear regression and correlation to help reach conclusions. They will choose their own model(s), as a group, to conduct Lab 6.
	d. Mammal natural history and its interpretation constantly evolves as scientists use emerging techniques and technologies to gather and analyze information. Students in *Mammalogy* will regularly observe uncertainties in their observations such as whether they made a precise and accurate measurement of a specimen, identified a biological feature properly, acquired and tabulated the correct count of organisms spatially. As they work individually on repeated procedures such as owl pellets analysis, they will gain an appreciation of biological variation. Likewise, in their group projects students will gain an appreciation that the observations and data collected by others is not identical to theirs. This will require that they consider and revise interpretations as warranted.

	e. Students communicate their research and experimentation following a science journal format that includes the sections: abstract, introduction, literature review/statement of problem, methods, results, discussion, conclusion and references. The format of these learning activities necessitates that students make the crucial distinction between results and their subsequent interpretation and conclusions drawn from results. Likewise, the format for laboratory reports follows an exacting format: Title, Date, Lab Partners, Purpose, Introduction, Materials, Procedure, Data, Results, Conclusion and References. For Lab 6, the culminating group collaborative lab experience, students will co-present their experiment to all classmates using a typical conference presentation format.

SCPS Program - Course Learning Outcomes

FOR CREDIT-HOUR BASED DEGREE PROGRAMS (BAPS-Business Admin; BAPS-Computing; BA-Healthcare Admin; DCM etc.)

Students will accomplish the general learning outcomes for the course as well as the LSP and outcomes described above.

FOR COMPETENCE-BASED DEGREE PROGRAMS IN SCPS

The following SCPS competencies are offered through the Mammalogy course:

S1X	S2X	S3X	S4	S5

Competencies	
Competence Statement	**S-1-X** Can use public or private institutions or natural areas as resources for learning science.
Competence Statement	**S-2-X** Can describe, differentiate, and explain form, function, and variation within a mammal.
Competence Statement	**S-3-X** Can use scientific knowledge to understand varying perspectives on a mammal conservation issue.
Competence Statement	**S-4** Can describe and explain connections among diverse aspects of nature. Students demonstrate this competence by connecting mammal evolution to human health
Competence Statement	**S-5** Can explain and evaluate the nature and process of science. Students demonstrate this competence by employing scientific reasoning during lab activities which require testing hypotheses.

Learning Resources:

Required Textbook:
Clutton-Brock, J., & Wilson, D. E. (2002). Smithsonian handbook: mammals.

Paperback: 400 pages
Publisher: DK ADULT; 1st edition (March 1, 2002)
Language: English
ISBN-10: 0789484048
ISBN-13: 978-0789484048
Product Dimensions: 6 x 1 x 8.5 inches

Book(s) available at https://depaul.bncollege.com/ or through discount outlets (Amazon, Abe's *etc.)*

Scholarly Articles are available within modules or as E-reserves listed in Syllabus Appendix (below) and available at:

https://library.depaul.edu/services/Pages/Course-Reserves-Services.aspx

Recommended resource (not required):

Vaughan, T. A., J. N. Ryan, and N. J. Czaplewski.2015. mammalogy. 6th ed. Jones & Bartlett, Burlington, Massachusetts, 755 pp. ISBN 978-1-284-03209-3

Required Software:

- Excel and PowerPoint
- JR Screen Ruler (or similar) http://www.spadixbd.com/freetools/index.htm
- On Screen Protractor (or similar) https://sourceforge.net/projects/osprotractor/

Laboratory Resources Required

Owl Pellets
Owl Pellet Kit
(or direct from Oregon Owl Pellets)

Frog Dissection Simulations:
Frog Dissection
Frog Dissection X
Virtual frog Dissection

Brain Model
Brain Model

Human 3D Skeletal Model
Kinebody

Access to local Zoo, Museum and/or Natural Area

Video (embedded in course, no purchase required):

Attenborough, D. (Director). (2013). *David Attenborough's rise of animals: Triumph of the vertebrates – Episode 2: Rise of Mammals.*

Other Resources for Students

Institutions

Lincoln Park Zoo Mammals
https://www.lpzoo.org/animals/mammals

Field Museum Mammal Collections
https://collections-zoology.fieldmuseum.org/list?f%5B0%5D=ss_CatCatalog%3A%22Mammals%22
https://www.fieldmuseum.org/science/research/area/mammals

Community

American Society of Mammologists
http://nsdl.oercommons.org/courses/the-american-society-of-mammalogists/view

Animal Diversity Webb (Mammals)
https://animaldiversity.org/accounts/Mammalia/

Course Website: The *Mammalogy* course guide, course learning materials, discussion forums, and additional resource links including supplementary videos are available through the course management system, D2L™.

Writing Resources. DePaul offers a comprehensive suite of services for students to assist in their writing activities through the University Center for Writing-based Learning (UCWbL). In particular, students may request an appointment with Writing Tutors to get detailed feedback regarding an assignment such as their research paper. Another fine resource is The Purdue Online Writing Lab.

Learning Strategies, Deliverables, and Assessment Approaches:

Students will be assessed through a variety of approaches in *Mammalogy* including online discussions, lab reports, a research paper, and virtual fieldtrip reports.

Discussions. (100 points). Each module of the course has its own discussion forum for a total of 10. Discussion forum questions are formulated by the instructor to motivate student interaction and reflection around that week's topics. Discussions build on readings, hypotheses, data, and multimedia considered that week. An excellent response is considered 1) accurate, 2) original, 3) relevant, 4) teaches classmates something, 5) clearly incorporates information from the readings and/or other learning materials, and 6) is well written. Excellent responses add substantial teaching/learning presence to a course and stimulate additional thought about the topic under discussion.

Regular Lab Reports. (400 points total; 80 points each). For half of the modules of the course, students undertake lab activities structured to reinforce mammalogy principles and scientific reasoning. The regular labs are generally conducted over a two-week interval.

Lab 1-Mammal Identification: students analyze the kinds and numbers of small mammal specimens from an owl pellet kit to sharpen observation and categorization skills as well as learn to identify and assign to species basic mammal skeletal elements. Students contrast their specimens to an early fossil mammal. Individual students contribute their data to the class as a whole.

Lab 2- Mammal Anatomy: students 'dissect' virtual frog models to contrast them with a virtual dissection of a rat; taking measurements as helpful and comparing the arrangement and variation of organs of the two groups. Students employ models of mammal development and evolution to assess anatomical variations and test a biological evolution hypothesis.

Lab 3- Mammal Brain and Skull Development: students develop and test a hypothesis about the development of the primate brain by contrasting a scale model of the human brain to a database on mammal brains. Observations on photographic representations of brains in the database to test whether the size and positions of features show evolutionary patterns. In addition, students contrast their brain observations to the details about human brains with Alzheimer's disease testing a hypothesis of whether other mammals should have a lower incidence of the disease. Finally, students consider primate skull and brain development in relation to the fossil hominins.

Lab 4- Mammal Locomotion -Bipedality: students test biomechanical hypotheses on whether human bipedality is connected to health issues involving the spine, hips and legs. They undertake this investigation using a 3D skeletal model of a human, conducting measurements and observations of features, and contrasting these to a corresponding 3D representation of the entire skeletal anatomy of a quadruped (canid).

Lab 5- Mammal Ecology: students investigate their own ecological questions regarding mammal biogeography in relation to habitat variables such as habitat, climate, and time of day by using data collected by real-time trail cameras in Gorongosa National Park in Mozambique.

Group Collaborative Lab Experiment Report. (200 points)

Lab 6- Group-Determined Issue/Problem: Students research and collaborate to formulate an experiment that they can conduct at a Zoological Park, Natural History Museum, or Natural Area. In consultation with the instructor they formulate a hypothesis, design a methodology, cooperatively collect data from the institution, analyze results, and develop a joint report for submission (by Module 10). In the final week of the course they present their findings to classmates by way of a zoom conference.

Standard Lab Format and Resources

Title, Date, Lab Partners, Purpose, Introduction, Materials, Procedure, Data, Results, Conclusion and References

Supplementary Resources on Science Report Writing:

Lab Report Guide	https://lc.gcumedia.com/bio182l/lab-report-guide/v1.1/#/home
Writing a Biology Lab	https://www.wikihow.com/Write-a-Biology-Lab-Report
How to Conduct a Science Experiment	https://www.wikihow.com/Conduct-a-Science-Experiment

Group Collaborative Experiment Presentation (50 points)

Students will jointly prepare and present their experiment in a 12-15-minute conference modality (either narrated PowerPoint or Zoom recorded. The format for the presentation should parallel the structure of a lab report. (See detailed instructions at the course site)

Virtual Field Trip Reports. (150 points; 30 points each). Students are required to review, evaluate, and reflect on videos, simulations and other multimedia that reinforce module topics. An excellent summary has the following qualities: 1) a summary of the key concepts presented, 2) specific examples (e.g., fossils, mammal species, habitats, etc.), 3) a depiction of data generated as applicable, and 3) a statement of how this learning helped in gaining a better understanding of the module topic as well as observed weaknesses in the presentation, and 4) the summary is well written.

Research Paper Final Draft. (100 points). Students are provided detailed guidelines for writing a scientifically formatted short research paper. Papers are 6 pages long, must use 3 scholarly sources and cannot exceed 1200 words. See the course site for details. Early in the course they are required to submit their research question, hypothesis, and approach whereas their final draft is due near the end of the course. Papers center on a student-selected mammal group. An excellent research paper has the following qualities: 1) the research question is original and relevant; 2) paper adheres to the required scientific format; 3) resources are scholarly and relevant; 4) scholarly information is integrated and synthesized; 5) citations are of proper format and used consistently; 6) information is evaluated reasonably and critically; 7) corresponding conclusions are consistent with preceding information.

Summary of Assignments, Point Values, and Percentages

Grading Category:	**Number of Assignments**	**Point Value Each**	**Total Point Value**	**% of Final Grade**
Discussions	10	10	100	10%
Regular Lab Reports	5	80	400	40%
Group Lab Reports	1	200	200	20%
Group Lab Presentation	1	50	50	5%
Research Paper (Final)	1	100	100	10%
Virtual Fieldtrip Reports	5	30	150	15%
Total			**1000 Points**	100%

Student Time Commitment to Practical Learning (Excludes reading, research, paper writing and study)

Laboratories	**Seat Time** Minimum Expected Time Allotment Includes preparation, conducting lab, notetaking, developing formal report, and sharing and analyzing data with class as applicable.	
Lab 1-Mammal Identification	**3 Hours**	
Lab 2- Mammal Anatomy	**3 Hours**	
Lab 3- Mammal Brain and Skull Development	**3 Hours**	
Lab 4- Mammal Bipedality	**3 Hours**	
Lab 5- Mammal Ecology	**3 Hours**	
Lab 6- Group-Determined Mammal Hypothesis:	**5 Hours** (Includes a 1-hour organizing meeting as well as site visit, conducting experiment, notetaking, analysis and developing formal group report.)	
	Subtotal	**20 Hours**
Discussions	**0.5 hours each X 10** (Includes review of other student responses and an original contribution)	**5 Hours**
Virtual Fieldtrips	**1.0 hour each X 5** (Includes conducting simulation and/or review of multimedia)	**5 Hours**
Group Presentation	**3.0 hours** (Includes group presentation and listening to and assessing other groups)	**3 Hours**
	Total	**33 Hours**

Writing Expectations

To assess student learning, the *Mammalogy* course incorporates several forms of writing assignments including laboratory reports (6), a research paper following a scientific journal format, virtual fieldtrip summaries (5), weekly online discussions, and a group presentation of the collaborative experiment. The laboratory reports incorporate worksheets that serve as the general template to collect and analyze data and a summary/conclusion section in essay format. The required research paper follows a science journal format and has a length of 1,200 words. Five virtual field trip summaries at 250 words each are submitted on a standardized form centering on case examples and student reflection. Finally, students' weekly discussions conducted online require original written contributions based upon course materials as well as collegial responses with other students around their submissions.

Each writing assignment type above has a detailed set of instructions and assessment rubric which is provided to students in the *Mammalogy* course guide. All writing assignments are expected to conform to basic college-level standards of mechanics and presentation.

Expectations for Collaborative Work

For Groups Labs:

Preparation: Each student should be prepared to conduct the lab activity by reviewing supporting instructions, examples, and materials.

Conducting Experiments: Each student will actively and evenly contribute to accomplishing the lab procedures and data collection. Delegation of work will be discussed and agreed upon before the lab commences. Work will be conducted under a framework of mutual respect acknowledging the importance of cooperation to the success of the team's experiment.

Analysis and Dissemination: Team members will discuss their experimental results including possible sources of error. Likewise, they will review strategies to analyze data to evaluate the experimental hypothesis. Team members will be individually responsible for conveying lab data, results, analysis and conclusions on the provided lab worksheets and submitting them to the grading area. Where requested, the team will deliberate the experimental findings and disseminate unified conclusions to the class as a whole.

Grading Policies and Practices:

To complete the course, students must fulfill each of the assignments as described in the course and submit them to the instructor by the assigned deadline. In addition, students must participate in the course discussion forum by responding to all instructor requests and by interacting with fellow classmates as necessary. Points will be deducted for late work that has not been exempted with the instructor (i.e., for medical or significant personal reasons).

This course utilizes the Turnitin plagiarism software for all assignments. Deliverables that have been determined to be extensively plagiarized from other students (past and present) will be given a zero grade with no option for resubmission. A zero will also be given to the provider of the assignment. Multiple occurrences of plagiarism by a student will bring about an Academic Integrity violation report.

Course Grading Scale for *Mammalogy*

Grading Scale	Percentage	Verbal Descriptor
A	100-93%	Excellent
A-	92-90%	
B+ -> B-	89-80%	Very Good
C+ -> C-	79-69%	Satisfactory
D+ -> D-	68-60%	Poor
F	< 60%	Unacceptable

DePaul University Rubric for Letter Grades

A The instructor judged the student to have accomplished the stated objectives of the course in an EXCELLENT manner.
B The instructor judged the student to have accomplished the stated objectives of the course in a VERY GOOD manner.
C The instructor judged the student to have accomplished the stated objectives of the course in a SATISFACTORY manner.
D The instructor judged the student to have accomplished the stated objectives of the course in a POOR manner.
F The instructor judged the student NOT to have accomplished the stated objectives of the course.
IN Temporary grade indicating that, following a request by the Student, the Assistant Dean for Student Affairs and the Instructor have given permission for the student to receive an incomplete grade.

Incomplete (IN) Grade: This process follows university policy.
A student who encounters an unusual or unforeseeable circumstance that prevents her/him from completing the course requirements by the end of the term may request a time extension to complete the work.

- The student must formally initiate the request by submitting the Contract for Issuance of Incomplete Grade form (via email, word doc), no later than week 10 (or prior to the final week of a shorter-term course).

- The instructor has discretion to approve or not approve the student's request for an IN grade.
- The instructor has discretion to set the deadline for completion of the work, which may be earlier but no later than two quarters (not counting Summer term).
- The instructor may not enter an IN grade on behalf of a student without a completed and agreed upon contract.
- The student is alerted that IN grades are not considered by Financial Aid as evidence of satisfactory academic progress.

In order to qualify, the student must have:

1. satisfactory record in the work already completed in the course;
2. encountered unusual or unforeseeable circumstances, which prevent him/her from completing the course requirements before the end of the term; and
3. applied to the instructor and to the Assistant Dean for permission to receive the IN. The incomplete will expire at the end of the following semester. If the work is not complete, the student will receive a failing grade.

Pass/Fail Exclusions

You may not use the Pass/Fail grading option if you are using this course to meet Liberal Studies Program (LSP) requirements. Likewise, if this course is taken to meet a requirement in your major (including intended and pre-majors), minor, and/or certificate (including intended and pre- minors/certificates) you may not use the Pass/Fail option.

Assessment Rubrics for Chief Learning Activities

Discussion Forum Rubric

The instructor expects that students will contribute to discussions each week. For online discussions, the instructor uses the rubrics described below (modeled after Pelz, 2004). Take this into consideration as you prepare and participate in class discussions.

LEVEL	INTERPRETATION	CHARACTER OF THE CONTRIBUTION
4	Excellent	The comment is 1) accurate, 2) original, 3) relevant, 4) teaches us something, and 5) is well written (where posted online). Four-point comments add substantial teaching presence to a course and stimulate additional thought about the issue under discussion. Likewise, a response to another student's postings should also have these qualities.
3	Above Average	The comment lacks at least one of the above qualities, but is above average in quality. A level 3 comment makes a significant contribution to our understanding of the issue being discussed.
2	Average	The comment lacks two or three of the required qualities. Comments which are based on personal opinion or personal experience are often within this category.
1	Minimal	The comment presents little or no new information. However, level 1 comment may provide important social presence and contribute to a collegial atmosphere.
0	Unacceptable	The comment adds no value to the discussion.

Virtual Fieldtrip and Simulation Report Rubric

LEVEL	INTERPRETATION	CHARACTER OF THE CONTRIBUTION
4	Excellent	The report summarizes addresses and/or has the following qualities: 1) Your observations (what you observed and/or read about during your learning activity). 2) Specific examples of what you observed (e.g., species, habitats etc.) 3) How this learning helped you to gain a better understanding of the course topic. 4) The theories, principles and information reviewed. 5) and information is accurately communicated and report is well written.
3	Above Average	The report lacks at least one of the above qualities, but is above average in quality. A level 3 report demonstrates a strong understanding of the issue being discussed.
2	Average	The report lacks two or three of the required qualities. A level 2 report demonstrates a reasonable understanding of the issue being discussed.
1	Minimal	The report presents little evidence of the above qualities. A level 1 report demonstrates a nominal understanding of the issue being discussed.
0	Unacceptable	The report does not demonstrate understanding of the fieldtrip topics.

Laboratory Rubric

Lab Assessment Rubric (**4= Excellent** 3=Above Average 2 =Average 1 = Minimal 0 = Unacceptable**)**			
Student Name			
	Lab Report Features	**Present**	**Absent**
	Introduction and purpose to lab clearly explained.		
	Hypothesis, and Variables clearly stated and identified		
	Procedures/methods clearly developed and stated		
	Data was accurate and/or specific examples were clear. Data is represented including copied tables etc.		
	Data analysis was accurate and clear.		
	Results were connected to the theories, principles and/or information conveyed in the lab activity.		
	The limitations of the lab are briefly summarized.		
	Conclusions are consistent with results/findings.		
	Report is accurately communicated and well-written.		
	Lab notes are thorough and represent clear progression through the lab.		
	Lab Check Photo included verifying participation Love the man and best friend shot.		
General Assessment (including in comparison to classmates' reports)			
Excellent	Has all of the above qualities (Level 4)		
Above Average	The report lacks or is weak in at least one of the above qualities, but is above average in quality. A level 3 report demonstrates a strong understanding of the issue being discussed.		
Average	The report lacks two or three of the required qualities. A level 2 report demonstrates a reasonable (passing) understanding of the issue being discussed.		
Minimal	The report presents little evidence of the above qualities. A level 1 report demonstrates a nominal understanding of the issue being discussed.		
Unacceptable	The report does not demonstrate understanding of the lab topics.		
	Final Score –		

Research Paper Rubric

LEVEL	POINT EQUIVALENT (EXAMPLE)	INTERPRETATION	
4	100-90	Excellent	A level 4 Paper has these qualities: 1. Research question is relevant to the course subject. 2. Paper adheres to the required scientific format. 3. Paper addresses and clearly connects to a course learning outcome. 4. Resources are scholarly and relevant. 5. Scholarly information is integrated and synthesized. 6. Citations are of proper format and used consistently. 7. Information is evaluated reasonably and critically. 8. Corresponding conclusions are consistent with preceding information and arguments. 9. Report is well written (grammar, flow and spelling).
3	89-80	Very Good	The paper lacks at least one of the above qualities, but is above average in quality. A level 3 report demonstrates a strong understanding of the issue being discussed.
2	79-69	Average	The paper lacks two or three of the required qualities. . A level 2 report demonstrates a reasonable understanding of the issue being discussed.
1	68-60	Poor	The paper presents little evidence of the above qualities. A level 1 report demonstrates a nominal understanding of the issue being discussed.
0	59-0	Unacceptable	The paper does not demonstrate understanding of the topic.

Course and Workload Expectations:

Workload, Time Management, and Attendance

This **online asynchronous** course is not self-paced and requires a regular time commitment each week throughout the quarter. Students are required to log in to the course at least four times a week so that they can participate in the ongoing course discussions. The expected time allotment for the various practical activities of the course is provided above. Students are expected to participate in the required synchronous activities.

Online courses are no less time consuming than onsite courses. Students will have to dedicate some time every day or at least every second day to their studies to do excellent in *Mammalogy*.

Discussion Forums

Discussion Forums are an important component of a student's online experience. This course contains discussion forums related to the topic(s) students are studying each week. A Course Q & A discussion forum has also been established to manage necessary, ongoing social and administrative activities. This is where the management and administrative tasks of the course are conducted, and where students can ask 'process' questions and receive answers throughout the course.

Synchronous Learning Activities

Students participate in synchronous presentations and interactions with other students (e.g., Zoom conferences). This course also involves one onsite group laboratory assignment at a zoological park, natural history museum, or natural area. Students are required to coordinate and attend the group activity.

Course Netiquette

Online discussions are an important part of the course experience. To ensure a positive learning environment, students should follow the guidelines below:

- Be polite

- Respect other participants' views or opinions
- Think before you write, and ask yourself if you would say the same thing in person
- Use positive phrases (i.e., "Good idea!" or "Thanks for the suggestions," etc.)
- Be sensitive to cultural differences
- Avoid hostile, curt or sarcastic comments
- No objectionable, sexist, racist, or politically intolerant language will be accepted.
- Create a positive online community by offering assistance and support to other participants.
- Use correct grammar and syntax

Instructor's Role

The instructor's role in this course is that of a discussion and laboratory facilitator as well as learning advisor. It is not their responsibility to make sure students log in regularly and submit their assignments. The instructor will read all postings to the general discussion forums but may not choose to respond to each posting. Students will receive individual feedback to all assignments through the D2L assessment system.

Office Hours

Students will receive timely response to questions and input on D2L or by direct e-mail. Students will receive a response to emailed or posted queries within 48 hours during business days. Students may also consult synchronously with the instructor (Office or Zoom) regarding ongoing learning activities such as laboratory assignments, virtual fieldtrips and research papers with the instructor upon request.

Student's Role

Online students must take a proactive approach to their learning. As the course instructor's role is that of a learning guide, the role of the student is that of the leader of their own learning. Students will be managing their own time to assure completion of the readings, activities and assignments for the course. In addition, students are expected to take a more active role in peer learning expressed in the discussion forums and in group learning during lab activities. A key to success in online learning is keeping pace with the sequential activities of the course and not falling behind.

Course Schedule

Mammalogy Course Schedule

Mod #	Wk #	Topics	Discussion Forum Themes	Readings	Laboratory Exercises	Virtual Fieldtrips	Supplemental Multimedia (including labs)	Other Assignments
1	1	**General Characteristics and Origin of Mammals**	What are the specific distinguishing characteristics of mammals? (e.g., reproduction, jaws teeth, ears etc.,)	Clutton-Brock p. 1-32	**Lab 1 Mammal identification Lab** • Scientific Experimentation • Owl pellets • Comparison to early placental mammals		Barn Owls https://www.barnowltrust.org.uk/barn-owl-facts/barn-owl-pellet-analysis/	**Research Paper Start**
2	2	**Mammalian Evolution**	When did mammals originate How did the key distinctive features arise? What were the patterns of mammal diversification in the Mesozoic versus the Cenozoic? What can we deduce from the fossil and molecular record about the early development of Placental Mammals including timing?	Required: Luo, Z. X. (2007). Transformation and diversification in early mammal evolution. *Nature*, *450*(7172), 1011. O'Leary, M., Bloch, J., Flynn, J., Gaudin, T., Giallombardo, A., Giannini, N., . . . Cirranello, A. (2013). The placental mammal ancestor and the post—k-pg radiation of placentals. *Science, 339*(6120), 662-667.		**VF1** **Video:** Attenborough, D. (Director). (2013). *David Attenborough's rise of animals: Triumph of the vertebrates – Episode 2: Rise of Mammals.* https://www.youtube.com/watch?v=E27KBfv_MEQ		
3	3	**Mammalian Biodiversity & Classification**	By what biological criteria are mammals classified? What is the current Biodiversity of major mammal groups?	Required: Clutton-Brock p. 52—53 Asher, R. J., & Helgen, K. M. (2010). Nomenclature and placental mammal phylogeny. *BMC Evolutionary Biology*, *10*(1), 102.	**Lab 2 Mammal Anatomy Lab** • Mammal – Amphibian Comparative Anatomy • Frog dissection kit versus fetal pig (simulation)		**Virtual Frog Dissection** https://www.biologycorner.com/worksheets/frog_alternative.html Vertebrate Circulatorium https://www.biointeractive.org/classroom-resources/vertebrate-circulatorium Interactive Human Autopsy	**Research Paper Hypothesis and Initial References**

							https://australianmuseum.net.au/learn/teachers/learning/virtual-autopsy/	
4	**4**	**Mammalian Anatomy** **(Brain)**	What is pattern of mammal brain development across groups and particularly its development towards the human species? What human medical issues are tied to human brain development? Pick an aspect of Mammal Embryology and describe it. https://embryology.med.unsw.edu.au/embryology/index.php/Main_Page	Required: Toledano, A., Alvarez, M. I., López-Rodríguez, A. B., Toledano-Díaz, A., & Fernández-Verdecia, C. I. (2012). Does Alzheimer's disease exist in all primates? Alzheimer pathology in non-human primates and its pathophysiological implications (I). *Neurología (English Edition)*, *27*(6), 354-369. https://www.sciencedirect.com/science/article/pii/S2173580812001071	**Lab 3 Mammal Brain and Skull Development Lab** • Brain Model • Mammal Brain Database		Human Origins Biointeractive (Brain and Technology Development) https://media.hhmi.org/biointeractive/click/human-origins/ Alzheimer's Disease: Piecing Together the Evidence https://www.biointeractive.org/classroom-resources/alzheimers-disease-piecing-together-evidence Brain Museum UW http://brainmuseum.org/	
5	**5**	**Mammal Locomotion**	What are the characteristics of the human skeleton as a result of bipedality? What are the health consequences of bipedality?	Latimer, Bruce. "The perils of being bipedal." *Annals of Biomedical Engineering* 33, no. 1 (2005): 3-6. https://www.researchgate.net/publication/8022849_The_perils_of_being_bipedal Latimer 2012 Perils of Being Bipedal Video: https://www.youtube.com/watch?v=afJA21CsbUo (1 Hour)		**VF2** **Website:** Mammal Locomotion http://mammals-locomotion.com/walking.html	10 biggest land mammals https://www.youtube.com/watch?v=w5Oz8MwXj4U	**Lab 6. Group – Mammal Laboratory Start** Groups Assigned Start Planning: Options 1-3 Crockett, C. M., & Ha, R. R. (2010). Data collection in the zoo setting, emphasizing behavior. Wild mammals in captivity: Principles and techniques for zoo management, 386-406.
6	**6**	**Mammal Metabolism, Feeding and Niches**	What are the common feeding niches of mammals?	Avaria-Llautureo, J., Hernández, C. E., Rodríguez-Serrano, E., & Venditti, C. (2019).	**Lab 4 Mammal Bipedality Lab**		Dog 3D http://www.real3danatomy.com/bones/dog-	**LAB 6 Summary of Group Experiment**

			How is the structure of mammal dentition related to feeding? Consequences of Human diet?	The decoupled nature of basal metabolic rate and body temperature in endotherm evolution. *Nature*, *572*(7771), 651-654. Schoeninger, M. J. (2012). Palaeoanthropology: The ancestral dinner table. *Nature*, *487*(7405), 42. Mammal Dentition/Skull http://www.humanevolution.news/fossil-hominins-had-the-same-dental-problems-as-us/	• Skeletal Model comparison with 3D Dog		skeleton-3d.html Mammal feeding Diversity of Cheek Teeth https://animaldiversity.org/collections/mammal_anatomy/tooth_diversity/ https://animaldiversity.org/collections/mammal_anatomy/tooth_introduction/	**Plans provided to instructor.**
7	**7**	**Mammal Behavior**	What are the variations in mammal behavior? Mammal Diversity Niche Partitioning in particular groups. Data from Clutton-Brock Clutton-Brock 54-381 What are the variations in primate behavior?	Van Valkenburgh, B., & Wayne, R. K. (2010). Carnivores. *Current biology*, *20*(21), R915-R919. https://www.sciencedirect.com/science/article/pii/S0960982210010948 **OPTIONAL:** Mazel, F., Wüest, R. O., Gueguen, M., Renaud, J., Ficetola, G. F., Lavergne, S., & Thuiller, W. (2017). The geography of ecological niche evolution in mammals. *Current Biology*, *27*(9), 1369-1374.		**VF3** **Website:** Behavior Based on Form Smithsonian Museum Virtual Trip Floor 1 and Floor 2 (Mammals and Bones) https://naturalhistory2.si.edu/vt3/NMNH/	Primate Behavior http://humanorigins.si.edu/evidence/behavior/primate-behavior	
8	**8**	**Mammal Biogeography /Habitats**	Where are mammals distributed around the earth? Zoonotic Infections. How is the health of humans impacted by overlapping ranges with mammals? How are other mammal species in turn impacted by humans?	Clutton-Brock p. 34—42 Davies, T. J., Buckley, L. B., Grenyer, R., & Gittleman, J. L. (2011). The influence of past and present climate on the biogeography of modern mammal diversity. *Philosophical Transactions of the Royal Society B: Biological Sciences*, *366*(1577), 2526-2535. https://royalsocietypublishing.org/doi/pdf/10.1098/rstb.2011.0018	**Lab 5 Mammal Ecology Lab** • This interactive module allows students to investigate their own ecological questions using data collected by trail cameras in Gorongosa National Park in Mozambique.		https://www.biointeractive.org/classroom-resources/gorongosa-national-park-interactive-map	

				Schrauwen, E. J., & Fouchier, R. A. (2014). Host adaptation and transmission of influenza A viruses in mammals. *Emerging microbes & infections*, *3*(1), 1-10. https://scholar.google.com/scholar?output=instlink&q=info:q8ItFoeM7CQJ:scholar.google.com/&hl=en&as_sdt=0,14&as_ylo=2010&scillfp=9168530294610239503&oi=lle				
9	**9**	**Mammal Genetics**	How do mammals differ in their genetic characteristics? What can be learned about human health through comparative genetics with other mammals (e.g., cancer suppression)?	Tarver, J. E., Dos Reis, M., Mirarab, S., Moran, R. J., Parker, S., O'Reilly, J. E., ... & Peterson, K. J. (2016). The interrelationships of placental mammals and the limits of phylogenetic inference. *Genome biology and evolution*, *8*(2), 330-344. https://scholar.google.com/scholar?output=instlink&q=info:fyLAY06n-ZsJ:scholar.google.com/&hl=en&as_sdt=0,14&as_ylo=2012&scillfp=10240889319275908927&oi=llev Tollis, M., Schiffman, J. D., & Boddy, A. M. (2017). Evolution of cancer suppression as revealed by mammalian comparative genomics. *Current opinion in genetics & development*, *42*, 40-47.		**VF4** **DNA Simulation:** **https://www.biologycorner.com/worksheets/DNA-sim.html** **Simulations:** Zoo breeder https://mnzoo.org/games/matchmaker/ Niche Partitioning and DNA Metabarcoding https://www.biointeractive.org/classroom-resources/niche-partitioning-and-dna-metabarcoding	More on Genetics **Optional:** Gene Transcription and Translation: https://www.youtube.com/watch?v=bKIpDtJdK8Q Regulation of Genes: https://www.youtube.com/watch?v=J9jhg90A7Lw&list=TLPQMDUwMzIwMjAQ6pyPx6kgwg&index=2 About Genetic Enhancers in Cells: https://www.youtube.com/watch?v=9ZRqc5dT6aY Villar, D., Berthelot, C., Aldridge, S., Rayner, T. F., Lukk, M., Pignatelli, M., ... & Turner, J. M. (2015). Enhancer evolution across 20 mammalian species. *Cell*, *160*(3), 554-566.	

10	**10**	**Conserving and Sustaining Mammal Biodiversity**	What are chief ways of sustaining mammal biodiversity? What dependencies do humans have on other mammals? How is human health impacted by other mammal species?	Clutton-Brock p. 44—51 Brum, F. T., Graham, C. H., Costa, G. C., Hedges, S. B., Penone, C., Radeloff, V. C., ... & Davidson, A. D. (2017). Global priorities for conservation across multiple dimensions of mammalian diversity. *Proceedings of the National Academy of Sciences*, *114*(29), 7641-7646. https://www.pnas.org/content/pnas/114/29/7641.full.pdf		**VF5** **Simulation:** CSI Wildlife (Elephant DNA profiling) https://www.biointeractive.org/classroom-resources/csi-wildlife		**Research Paper Due**
	11							**Group Presentation of Research**

Course Policies:

This course includes and adheres to the college and university policies described in the links below:

- APA citation format
- Academic Integrity Policy
- Incomplete (IN) and Research (R) Grades Expiration Policy
- Course Withdrawal Timelines and Grade/Fee Consequences
- Accommodations Based on the Impact of a Disability
- Protection of Human Research Participants

DePaul University Resources for Students:

- Student Resources

About the Course Author:

Kevin F. Downing, Professor – DePaul University

Dr. Downing is a Professor at DePaul University's School of Continuing and Professional Studies. He is a paleobiologist with research interests that include the investigation of fossil mammals and corals as well as online science learning practices. He is the author of numerous publications in geology, paleontology and science education and is the co-author of the book, Online Science Learning: Best Practices and Technologies. Dr. Downing received B.S. degrees in Astronomy and Geology (University of Illinois-Champaign), an M.S.T. in Geology (University of Florida-Gainesville), and Ph.D. in Geosciences with a minor in Evolutionary Biology and Ecology (University of Arizona, Tucson).

Credits
This course was authored and designed by Dr. Kevin F. Downing and embedded for online use at DePaul University by the staff at DePaul's Center for Teaching and Learning.

Appendix I (Journal Resources List by Module Topic)

MAMMALOGY [CCS 320 and SNC 320]

Module 1	**General Characteristics and Origin of Mammals**
	Clutton-Brock, J., & Wilson, D. E. (2002). Smithsonian handbook: mammals.
Module 2	**Mammalian Evolution**
	Anthwal, N., Joshi, L., & Tucker, A. S. (2013). Evolution of the mammalian middle ear and jaw: adaptations and novel structures. *Journal of anatomy*, *222*(1), 147-160. Asher, R. J., Bennett, N., & Lehmann, T. (2009). The new framework for understanding placental mammal evolution. Bioessays, 31(8), 853-864. dos Reis, M., Inoue, J., Hasegawa, M., Asher, R. J., Donoghue, P. C., & Yang, Z. (2012). Phylogenomic datasets provide both precision and accuracy in estimating the timescale of placental mammal phylogeny. *Proceedings of the Royal Society B: Biological Sciences*, *279*(1742), 3491-3500. Lee, M. S., & Beck, R. M. (2015). Mammalian evolution: a Jurassic spark. *Current Biology*, *25*(17), R759-R761. Luo, Z. X. (2007). Transformation and diversification in early mammal evolution. *Nature*, *450*(7172), 1011. Maier, W., & Ruf, I. (2016). Evolution of the mammalian middle ear: a historical review. *Journal of anatomy*, *228*(2), 270-283. O'Leary, M., Bloch, J., Flynn, J., Gaudin, T., Giallombardo, A., Giannini, N., . . . Cirranello, A. (2013). The placental mammal ancestor and the post—k-pg radiation of placentals. *Science, 339*(6120), 662-667. Wildman, D. E. (2011). Toward an integrated evolutionary understanding of the mammalian placenta. *Placenta*, *32*, S142-S145. Zhou, Y., Shearwin-Whyatt, L., Li, J., Song, Z., Hayakawa, T., Stevens, D., ... & Zhang, G. (2021). Platypus and echidna genomes reveal mammalian biology and evolution. *Nature*, *592*(7856), 756-762.
Module 3	**Mammalian Biodiversity & Classification**
	Asher, R. J., & Helgen, K. M. (2010). Nomenclature and placental mammal phylogeny. *BMC Evolutionary Biology*, *10*(1), 102.
Module 4	**Mammalian Anatomy**
	Blaisdell, A. P. (2018). How to build a human brain: Evolution, development, and education. *Journal of Evolution and Health*, *3*(2), 5.

	Chimento, N. R., & Agnolin, F. L. (2020). Phylogenetic tree of Litopterna and Perissodactyla indicates a complex early history of hoofed mammals. *Scientific reports*, *10*(1), 1-10. Herculano-Houzel, S. (2015). Decreasing sleep requirement with increasing numbers of neurons as a driver for bigger brains and bodies in mammalian evolution. *Proceedings of the Royal Society B: Biological Sciences*, *282*(1816), 20151853. Heuer, E., F Rosen, R., Cintron, A., & C Walker, L. (2012). Nonhuman primate models of Alzheimer-like cerebral proteopathy. *Current pharmaceutical design*, *18*(8), 1159-116 Jensen, B., Wang, T., Christoffels, V. M., & Moorman, A. F. (2013). Evolution and development of the building plan of the vertebrate heart. *Biochimica et Biophysica Acta (BBA)-Molecular Cell Research*, *1833*(4), 783-794. Rosen, R. F., Walker, L. C., & LeVine III, H. (2011). PIB binding in aged primate brain: enrichment of high-affinity sites in humans with Alzheimer's disease. *Neurobiology of aging*, *32*(2), 223-234. Toledano, A., Alvarez, M. I., López-Rodríguez, A. B., Toledano-Díaz, A., & Fernández-Verdecia, C. I. (2012). Does Alzheimer's disease exist in all primates? Alzheimer pathology in non-human primates and its pathophysiological implications (I). *Neurología (English Edition)*, *27*(6), 354-369.
Module 5	**Mammal Locomotion**
	Biewener, A. A. (1990). Biomechanics of mammalian terrestrial locomotion. *Science*, *250*(4984), 1097-1103. Biewener, A. A. (2005). Biomechanical consequences of scaling. *Journal of Experimental Biology*, *208*(9), 1665-1676. Curth, S., Fischer, M. S., & Kupczik, K. (2017). Patterns of integration in the canine skull: an inside view into the relationship of the skull modules of domestic dogs and wolves. *Zoology*, *125*, 1-9. Jean, L. (2011). Analysis of the dynamic sagittal balance of the lumbo-pelvi-femoral complex. In *Biomechanics in applications*. InTech. Johnson, M. I. (2019). Opinions on Paleolithic physiology living in painogenic environments: Changing the perspective through which we view chronic pain. *Pain management*, *9*(3), 219-224. Jurmain, R. (2000). Degenerative joint disease in African great apes: an evolutionary perspective. *Journal of Human Evolution*, *39*(2), 185-203. Latimer, Bruce. "The perils of being bipedal." *Annals of Biomedical Engineering* 33, no. 1 (2005): 3-6. McGowan, C. P., & Collins, C. E. (2018). Why do mammals hop? Understanding the ecology, biomechanics and evolution of bipedal hopping. *Journal of Experimental Biology*, *221*(12), jeb161661. Plomp, K. A., Viðarsdóttir, U. S., Weston, D. A., Dobney, K., & Collard, M. (2015). The ancestral shape hypothesis: an evolutionary explanation for the occurrence of intervertebral disc herniation in humans. *BMC evolutionary biology*, *15*(1), 68.

	Ryan, T. M., & Shaw, C. N. (2015). Gracility of the modern Homo sapiens skeleton is the result of decreased biomechanical loading. *Proceedings of the National Academy of Sciences*, *112*(2), 372-377. Saibene, F., & Minetti, A. E. (2003). Biomechanical and physiological aspects of legged locomotion in humans. *European journal of applied physiology*, *88*(4-5), 297-316. Steele Ph D, J. (2017). An evolutionary hypothesis to explain the role of deconditioning in low back pain prevalence in humans. *Journal of Evolution and Health*, *2*(2), 1. Whiting, W. C., & Zernicke, R. F. (2008). *Biomechanics of musculoskeletal injury*. Human Kinetics.
Module 6	**Mammal Metabolism and Feeding**
	Avaria-Llautureo, J., Hernández, C. E., Rodríguez-Serrano, E., & Venditti, C. (2019). The decoupled nature of basal metabolic rate and body temperature in endotherm evolution. *Nature*, *572*(7771), 651-654. Bergman, A., & Casadevall, A. (2010). Mammalian endothermy optimally restricts fungi and metabolic costs. *MBio*, *1*(5), e00212-10. Fisher, R. E. (2000). The primate appendix: a reassessment. *The Anatomical Record: An Official Publication of the American Association of Anatomists*, *261*(6), 228-236. Flouris, A. D., & Piantoni, C. (2015). Links between thermoregulation and aging in endotherms and ectotherms. *Temperature*, *2*(1), 73-85. Gibbons, A. (2012). An evolutionary theory of dentistry. Kemp, T. S. (2006). The origin of mammalian endothermy: a paradigm for the evolution of complex biological structure. *Zoological Journal of the Linnean Society*, *147*(4), 473-488. Schoeninger, M. J. (2012). Palaeoanthropology: The ancestral dinner table. *Nature*, *487*(7405), 42. Smith, H. F., Fisher, R. E., Everett, M. L., Thomas, A. D., Randal Bollinger, R., & Parker, W. (2009). Comparative anatomy and phylogenetic distribution of the mammalian cecal appendix. *Journal of evolutionary biology*, *22*(10), 1984-1999. Zou, D., Zhao, J., Ding, W., Xia, L., Jang, X., & Huang, Y. (2010). Wisdom teeth: Mankind’s future third vice-teeth?. *Medical hypotheses*, *74*(1), 52-55.
Module 7	**Mammal Behavior**
	Crockett, C. M., & Ha, R. R. (2010). Data collection in the zoo setting, emphasizing behavior. *Wild mammals in captivity: Principles and techniques for zoo management*, 386-406. Van Valkenburgh, B., & Wayne, R. K. (2010). Carnivores. *Current biology*, *20*(21), R915-R919.
Module 8	**Mammal Biogeography/Habitats**

	Chapman, C. A., Gillespie, T. R., & Goldberg, T. L. (2005). Primates and the ecology of their infectious diseases: how will anthropogenic change affect host-parasite interactions? *Evolutionary Anthropology: Issues, News, and Reviews: Issues, News, and Reviews*, *14*(4), 134-144. Davies, T. J., Buckley, L. B., Grenyer, R., & Gittleman, J. L. (2011). The influence of past and present climate on the biogeography of modern mammal diversity. *Philosophical Transactions of the Royal Society B: Biological Sciences*, *366*(1577), 2526-2535. Han, B. A., & Ostfeld, R. S. (2019). Topic modeling of major research themes in disease ecology of mammals. *Journal of mammalogy*, *100*(3), 1008-1018. Mazel, F., Wüest, R. O., Gueguen, M., Renaud, J., Ficetola, G. F., Lavergne, S., & Thuiller, W. (2017). The geography of ecological niche evolution in mammals. *Current Biology*, *27*(9), 1369-1374. Schrauwen, E. J., & Fouchier, R. A. (2014). Host adaptation and transmission of influenza A viruses in mammals. *Emerging microbes & infections*, *3*(1), 1-10. Wolfe, N. D., Escalante, A. A., Karesh, W. B., Kilbourn, A., Spielman, A., & Lal, A. A. (1998). Wild primate populations in emerging infectious disease research: the missing link?. *Emerging infectious diseases*, *4*(2), 149.
Module 9	**Mammal Genetics**
	Baez-Ortega, A., Gori, K., Strakova, A., Allen, J. L., Allum, K. M., Bansse-Issa, L., ... & Corrigan, A. M. (2019). Somatic evolution and global expansion of an ancient transmissible cancer lineage. *Science*, *365*(6452), eaau9923. Briggs, J. A., Wolvetang, E. J., Mattick, J. S., Rinn, J. L., & Barry, G. (2015). Mechanisms of long non-coding RNAs in mammalian nervous system development, plasticity, disease, and evolution. *Neuron*, *88*(5), 861-877. Fay, J. C. (2013). Disease consequences of human adaptation. *Applied & translational genomics*, *2*, 42-47. Tarver, J. E., Dos Reis, M., Mirarab, S., Moran, R. J., Parker, S., O'Reilly, J. E., ... & Peterson, K. J. (2016). The interrelationships of placental mammals and the limits of phylogenetic inference. *Genome biology and evolution*, *8*(2), 330-344. Tollis, M., Schiffman, J. D., & Boddy, A. M. (2017). Evolution of cancer suppression as revealed by mammalian comparative genomics. *Current opinion in genetics & development*, *42*, 40-47. Villar, D., Berthelot, C., Aldridge, S., Rayner, T. F., Lukk, M., Pignatelli, M., ... & Turner, J. M. (2015). Enhancer evolution across 20 mammalian species. *Cell*, *160*(3), 554-566.
Module 10	**Conserving and Sustaining Mammal Biodiversity**
	Brum, F. T., Graham, C. H., Costa, G. C., Hedges, S. B., Penone, C., Radeloff, V. C., ... & Davidson, A. D. (2017). Global priorities for conservation across multiple dimensions of mammalian diversity. *Proceedings of the National Academy of Sciences*, *114*(29), 7641-7646.

	Gluckman, P. D., Low, F. M., Buklijas, T., Hanson, M. A., & Beedle, A. S. (2011). How evolutionary principles improve the understanding of human health and disease. *Evolutionary Applications*, *4*(2), 249-263. Robuchon, M., Pavoine, S., Véron, S., Delli, G., Faith, D. P., Mandrici, A., ... & Leroy, B. (2021). Revisiting species and areas of interest for conserving global mammalian phylogenetic diversity. *Nature Communications*, *12*(1), 1-11.