Review Article Assignment: A literature review paper is a course requirement. Groups of 3–5 persons will each select a focused topic in evolutionary biology, formulate a thesis about this topic, and research evidence supporting and potentially refuting this thesis. You will then write a review article similar to those in the Journal of Evolutionary Biology. For your paper, the target audience is the other members of the class. The paper is due April 28th at 8:00 am, submitted through blackboard.

CHOICE OF TOPIC

1. The topic must be within the field of evolutionary biology, either covered in class, in your text books, or perhaps not covered in this course. Above all, choose a topic about which you have developed some interest. The topic may be contemporary or historical, empirical or theoretical, organismal or molecular; but it must involve evolutionary biology. You may use the attached list of suggested topics for ideas, but do not feel that you should be limited to these topics (For example, you might be interested in "the origin of life on planet Earth").

2. Form a collaborative arrangement with other members in your group. The more collaborative you are, the more that everyone in the group will benefit. Obviously, everyone in your group should agree on a single topic that interests everybody. Your group should meet regularly to discuss the topic. Make sure to get contact information and start as soon as possible.

3. Do some preliminary reading about your topic. The UNT Library maintains an excellent collection of books and journals about evolutionary biology (contact Erin O’Toole, the biology librarian for assistance; she’s really nice and cool but start now). While reading, keep asking yourself if there is a thesis or theme that is being developed and if there are alternative explanations or hypotheses (For example, some references appear to suggest that life originated de novo on Earth in a "primordial soup", but other references appear to suggest an extraterrestrial origin for life on Earth). Keep records (e.g., on index cards) of what information came from which reference. Of course, you may find that you want to change your topic, or especially to focus and refining your topic after you have done preliminary readings.

4. Share and discuss your information with your other group members. It may be most beneficial if everyone in the group reads all the same references and discusses what they mean, how (or if) they fit into your project, how they can or cannot be used as evidence, and so on. Some groups may find it easier to have members specialize in a particular part of the research and present their readings to the group. In the latter (less preferable) case, of course, if the "specialist" doesn't get it exactly right, and the
group assumes that the "specialist" is an authoritative expert, the group will suffer as a whole.

5. Focus your topic quite narrowly to address a specific thesis or set of alternative theses. For example, a recent article in the journal *Science* presented evidence supporting the hypothesis that Earth was "seeded" by meteorites of Martian origin. But there are alternative explanations that suggest the Martian meteorites did not actually contain life forms. Focused topics are usually much better than broad, general topics—and easier to write about.

6. The thesis should be a single-sentence statement or proposition about how you view a particularly important aspect of your topic. For example, "the morphospecies concept is a generally practical, but not infallible, means of differentiating species", or "Darwin's interstrain crosses of pigeons demonstrate that several extreme variations may arise at single genetic loci". The thesis statement will be the first sentence of your paper and thus the topic sentence of your first paragraph.

7. Collect additional references to probe the depths of existing knowledge about your focused topic. Collect more evidence and questions that address your focused thesis at greater depth. To find additional and more recent references, use Biological Abstracts, Citation Index, the Web, etc. You may also want to go back and check the original literature cited by your current books or journal articles. Learn to use your library, it's an invaluable resource that you will miss when gone.

8. Test out each piece of evidence that you will use by constructively arguing about it with your collaborators. In what aspect(s) does the evidence fail to support your thesis? What alternative possibilities are definitely and not-so-definitely ruled out by the evidence? Ruling out alternatives is one good way to support your thesis. What experiments have not yet been done that you could propose that might fill in some of the details or patch some of the holes in the theory underlying your thesis?

**WRITING THE PAPER**

1. Decide if you will write a single paper as a group or if each individual will write his/her own paper. In the first case, all co-authors will be equally responsible and thus will get the same grade unless duties are otherwise noted. At the end of your paper, in a separate section, include a note of the contributions of each participant, if needed. If all were equal, there is no need for this section. For example: Smith and Williams researched topics and selected the thesis topic “A comparison of the evolution of limb development.” Smith reviewed papers for and wrote the section on “Avian limb development” and Williams reviewed paper for and wrote the section on "Mammal Limb development.” Both contributed to the the and submission process.
2. Do not just sit down and write your paper! Gather and arrange your information (data), thesis, and arguments. You may find it useful to take notes on cards, along with a note about the literature from which you collected your evidence or argument. Note cards can be shuffled into different orders, allowing you to easily construct and reconstruct different sequences of coherent ideas.

3. Construct a fairly detailed outline for your paper. You may find it very useful to actually write a "topic sentence" for each item in the outline that might represent a paragraph in the paper. The organization could be some topic-specific version of the following:

   a) Thesis paragraph
      - **Thesis statement** (this is ALWAYS the first sentence of your paper!)
      - How this thesis differs from alternative possibilities
      - The various kinds of evidence we have gathered that support this thesis

   b) Introductory and background material
      - The main question(s) or problem(s) to be addressed
      - Why this topic is significant (and why testing these hypotheses is important)
      - Observations that led to the thesis (and alternative theses)

   c) Predictions
      - Predictions of patterns or experimental results that would occur if the *alternative* theses were true
      - Predictions of patterns or experimental results given my thesis

   d) Evidence that supports the thesis and refutes the alternative theses-
      - For each piece of evidence, cite the appropriate reference and explain how these data both support the thesis and refute alternative theses.
      - **Back up each statement with EVIDENCE and the associated citation!**

   e) Explanation of anomalous data or data that might seem to refute the thesis-
      - If the thesis is supported, there should be an explanation for why seemingly anomalous data appear; try to resolve any apparent paradoxes. For example, Darwin argued that the disjunct distribution of cold-weather species on mountain tops could be explained by the glacial retreat as opposed to migration or special creation.

   f) Conclusion
      - Conclusions and speculations
      - Future prospects
        1. Questions or problems that remain unanswered
        2. Possible ways of answering or solving them
4. Cite specific evidence and construct specific arguments to support your thesis statement. Use data from your library references (books and journal articles) to support your thesis. You should also show what kind of data could refute your thesis. To make your arguments even stronger, you should also explain how the data refute alternative hypotheses. If there are data that are not explained by your thesis, discuss why such apparently anomalous data may exist, even if your thesis is true. Cite appropriate literature in the text whenever you use data or allude to someone else's work.

**IMPORTANT**: You must cite your references each time you use them in the text. For example: "That oxygen is a component of air is shown by heating metal oxides, collecting the resulting gas and testing its ability to support combustion (Lavoisier, 1778:23)", which cites page 23 in a book written by Antoine Lavoisier in 1778. You must also list the references by author at the end of your paper (in alphabetical order with all appropriate information, such as date, title and publisher if a book or title, journal, volume and pages if a journal article). Failure to do so constitutes plagiarism (i.e., the assumption of another author's work as your own).

**FORMAT**

**Length and Style**: The paper should be comprehensive and be of appropriate length to cover the subject (at least 3 pages). To familiarize yourself with a review article format, look up at least 2 published review articles in the Journal of Evolutionary Biology. You will generally use the format of that journal in conjunction with “How to Write a Biology Research Paper”, found on blackboard with the exception that in a review article, there are no separate sections for introduction, methods, results, etc., like are found in a research article, rather, any subsections will address subtopics of your main thesis.

**Literature Cited**: Your paper must contain at least 15 citations of reviewed literature (cited in the text and in a Literature Cited section). Non-reviewed literature (secondary or popular sources like your textbook or peer-reviewed web sites) may be used but only in addition to the 15 citations. On-line citations need to be cleared in advance. The format for the citations and literature cited section should follow the guidelines outlined in “How to Write a Biology Research Paper.” The title of the paper, author, course number, and date should be centered on the first page. There should be no separate title page. Use Arial font #12, 1.5 line spacing, 1-inch margins and left justification. To determine adherence to prescribed format, the method of citing sources in the text and the literature cited section will be the first thing evaluated. If the format is incorrect, the paper will be returned ungraded and docked up to 10 points. Good writing involves considerable reading and revisions based on the comments of reviewers. To this end have others read, edit, and criticize your work.
The phylogenetic origin of HIV
Poor fidelity in HIV reverse transcriptase is an adaptation to the host immune system. (Note that this is also an excellent example of a thesis statement.)
Cystic fibrosis has persisted in human populations because heterozygotes have a selective advantage. (Another excellent thesis statement.)
Molecular data is better than morphological data for phylogenetic inference.
Polymorphism has been maintained for tens of millions of years at the Major Histocompatibility Locus by means of "overdominant selection".
Mechanisms of recent evolution of antibiotic drug resistance in malaria or tuberculosis
What does "homology" really mean, and can it really be identified?
Transposable element evolution: lineal or reticulate?
Evolution of development
"Altruistic" behavior in social insects
Cooperative behavior in wolf packs: individual or "group" selection?
Undulapodia of eukaryotic cells resulted from endosymbiosis.
Biogeography of camelids
Natural selection as a useful tool in computer algorithms to solve multivariate problems
Natural selection as a useful algorithm in modern drug design by high-tech companies like "Molecular Evolution"
The relationships of tetrapods: are birds more closely related to "reptiles" or to mammals?
The real reason dinosaurs went extinct
Fungi are more closely related to animals than to plants.
Ancient gene duplications resolve the root to the tree of life.
Evolution of color vision in vertebrates
The relationship of humans to other primates
Phylogenetic evidence for the coevolution of nematode parasites and their mammalian hosts
• Darwin was not the first to propose Natural Selection as the main agent of evolutionary change. (Again, a thesis statement-the history of evolutionary science is also a perfectly legitimate topic!)

• Mapping genetic loci involved in the evolution of Drosophila head shape

• Genetic loci involved in Drosophila reproductive isolation (and thus speciation)

• Computer simulations of evolutionary genetic principles

• The evolution of sexual dimorphism, or of sex itself

• How did flight evolve in birds (or insects, mammals or reptiles)?

• How many times did flight evolve in mammals? There are two major bat lineages; did they evolve independently?

• The evolution of eyes: Convergence or ancient sharing of developmental mechanism?

• The evolution of eyes: Evidence for developmental constraint provides evidence against design. (Yet another thesis statement.)

• Even though he "lost" the great Académie debate of 1830 to his student, Geoffroy's proposal of typological homology between the body plans of insects and vertebrates (i.e., vertebrates are upside-down insects) has been vindicated by recent molecular evidence. (Or has it?) (Another thesis statement-one that combines a famous problem of classical importance with recent molecular evidence!)